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EDITORIAL NOTES.

Municipal Socialism.

THE subject of Municipal Socialism is one of the questions of the day which is constantly being pressed upon the attention of those who take an intelligent interest in public affairs. Of a truth these questions are so numerous and complex, that plain men may excusably try to rule off some of them as beyond their capacity and time for such inquiries, especially those which do not appear to touch their own proper concerns. Of such is the political controversy over the Education Bill, and certain other bones of contention between the Government and the Opposition. The trouble is that, however resolutely an honest citizen may determine to keep out of the way of these polemics, he is constantly being forced to take a side in them, one after another or all together, by the mere fact of his possessing a vote and being called upon to exercise this privilege of the franchise. Needless to say, one does not escape from responsibility in this respect by abstaining from voting, which is tantamount to taking a very influential part indeed in determining whatever may be the issues of a popular election. This reflection is of peculiar pertinence in regard to the direction of the machinery of local government. Under the prevailing system of government by elective bodies, every individual voter is responsible in his degree for the character of the administration that spends his money; and there is unfortunately too much experience of the deplorable results of indifference to this responsibility on the part of those who ought, for their own and others' sakes, to discharge it conscientiously and well.

In the affairs of local government in this country, events have for some time been working up to a climax, the nature of which was quite clearly set out in their respective manners by the Governor of the Gaslight and Coke Company and the Chairman of the South Metropolitan Gas Company, at the recent general meetings of these undertakings. The same witness has been borne by the official heads of the railway companies, and other spokesmen for the various kinds of rateable properties entering into the common category of contributories to the local rate funds without representation on the spending authorities. It is notorious that the tendency of modern industry and commerce is towards the joint-stock system of proprietorship; but it is perhaps not so well remembered that this process entails the loss of the direct power of sharing in the duty of local government which goes with individual ownership of a hereditament. This is no imaginary loss, or theoretical disability. Instances might be named, if it were necessary, of grave dislocations and miscarriages due to the fact of an impersonal proprietary paying the greater part of the rates of a local government district, while the rating authority is composed of persons without any immediate interest in the proper expenditure of the money. The same thing, in a degree, exists in all localities; and it is, as already remarked, everywhere an increasing degree.

Coincidently with this appearance and growth of the category of unrepresented ratepayers, there has appeared in the composition of local governing bodies the Socialist element. The fact is real and plain enough, yet it appears to be considered desirable in certain quarters to deny it; and denied it is accordingly. It is as "Progressives" that the Socialist element gained admission to public life in England, after a considerable period spent in wandering in the wilderness of aimless independent political agitation. Socialists, as such, had no difficulty in obtaining access to Continental Parliaments. But they could do nothing in this way in the United Kingdom, until they applied themselves to the Trade Unions, and cultivated the opportunities opened to them by the local elections. It was then discovered that Trade Unionism was Socialism, and also that the supply of such services as gas and water by the local authorities was Socialism; and the Socialists forthwith appropriated all these things to their own credit. Socialism, in short, was made the ring-fence of all these activities of English life, which had previously existed independently on their merits, without anybody suspecting the existence among them of a common principle; and it is an enclosure which is incessantly being enlarged, in the asserted cause of Progress.

In themselves, English Socialists are feeble folk. The Social Democratic Federation, the Independent Labour Party, and the Fabian Society do not count for much, even if there is added to them the Federation of Trades Unions and the London Trades Council. But they make themselves felt on such local authorities as admit the expert self-advertisers among their members. Here they take an active part in attacking individual trade and enterprise, and particularly in vilifying gas companies, water companies, electric lighting companies—the very class of property owners who pay rates without having the municipal vote. In view of the fundamental differences of spirit and purpose which municipal "trading" enterprise suffered when it was identified with Socialism and was renamed Progressivism, there is every justification for reconsidering the place which the former holds in British local government. It is one thing to regard upon its merits the proposed transfer (say) of a gas undertaking to a local authority on the ground of local expediency, and quite another matter to accept the existence of such transferred undertakings as evidence for Municipal Collectivism and against all company enterprise.

This is actually the climax of local government polity. In the circumstances, therefore, much interest attaches to the criticism of the subject which is now appearing in "The Times," the character of which may be appreciated by the following extract from the writer's preamble:—

> The time has, in fact, come for the British people to say whether or not they concur in the transfer, not only of great, speculative, and often even experimental industries, but of all sorts of minor trades as well, to municipal control; whether or not it is desirable that our towns and cities should be changed into essentially socialistic communities where trade, industry, and local government will all be conducted on socialistic lines; whether or not the incurring of stupendous financial liabilities, the rapid accumulation of local debts, and the increase to an almost unbearable extent of local taxation, are consistent with the best interests not only of the towns and localities concerned, but of the nation at large; and whether, assuming that all these things are right and desirable, the status of our local governing bodies is being maintained at so high a point that one may feel perfect confidence in their efficiency alike for dealing with questions of public health and ordinary local government, for the conduct of so many great and varied industries and enterprises, and for the wise and effective control of a huge municipal indebtedness so that it shall not become a menace to the welfare of the country.

These are tremendous terms of reference for any investigator to set for himself; and we shall follow the course of the inquiry with interest—specially treating anything which belongs to our own province of industry and enterprise.

Impeaching the South Metropolitan Gas Company.

A GENTLEMAN signing himself "Sidney Davies, M.D., "Medical Officer of Health, Woolwich," has written to some of the papers to give Sir George Livesey a Roland for his Oliver in the matter of municipal trading. It is always interesting, and may be instructive, to hear what our opponents have to say about us; and doubtless the Chairman of the South Metropolitan Company will be grateful for any disclosure of the existence of a state of discontent with the doings of the Company in one of their districts which would otherwise remain unknown. Dr. Davies thinks that the South Metropolitan Company's treatment of consumers in the matter of the reduction of illuminating power affords an argument for municipalization. Parliament reduced the illuminating power of the Company's gas, on condition that the Company were to supply gratis, to any consumers asking for them, burners suitable for the new grade of gas. Dr. Davies is convinced "by personal observation" that the great majority of householders have not profited by the Company's offer. This statement can scarcely mean that the energetic Medical Officer of Health has made a house-to-house visitation of the majority of the Company's customers. Yet, on such investigation as he has made,

he thinks himself justified in making public the assertion that "in thousands of the workers' homes more gas is "burnt, more air is consumed, and more poisonous products "are emitted, with consequent injury to health and waste of "money." Proof? Oh, no! This is the kind of statement which is never accompanied by any positive proofs. Not a consumer is cited by name and address as having burnt more gas or incurred a heavier doctor's bill in consequence of the Company's proceedings under their Act of 1900. We know that the Company's books do not show an abnormally increased sale of gas; so that, unless Dr. Davies has said the thing that is not, the question of how his suffering people obtained the increased amount of gas that hurts them so becomes a dark mystery. Dr. Davies ends his letter with this crushing remark: "If municipal electric lighting "increases the rates, it will not, at any rate—like company "gas—injure health." Now, what are the grounds for this injurious imputation? In what degree, and in what manner, is the public health of Woolwich affected by the continued existence of the South Metropolitan Gas Company?

Federation Bid for Supremacy in South Wales.

NEGOTIATIONS, the result of which must have a material effect upon the course of the coal trade during the early part of next year, have now been formally entered upon between the representatives of the coalowners and the miners in South Wales, as to the method of determining wages there after the present sliding-scale agreement has expired at the end of December next. The Joint Committee of owners and miners met ten days ago; and the men then laid before the other side their request for the substitution of a Conciliation Board for the present automatic system of determining wages, and for the fixing of a minimum and a maximum within which the Board should work—a minimum (40 per cent. above the standard) which we have previously shown to be absurdly high. After listening to the explanations and arguments the men had to offer, the owners asked for an adjournment in order that they might refer to their constituents, as they were not in a position to accept any of the principles underlying the proposals put forward by the men; and it is understood that the negotiations will not be resumed until about the middle of September.

This demand for the abolition of the sliding-scale and the introduction of a Conciliation Board is due, we know, to the fact that the Miners' Federation of Great Britain object "on principle" to a sliding-scale, and make its abolition a condition of their support of the South Wales Federation. But it is interesting to inquire into this hostility to sliding-scales, and into the question of what the miners in South Wales hope to gain by the change. By what means can a Coal Conciliation Board arrive at a determination as to whether wages should be raised or lowered? Either by regarding the general condition of the labour market, or by reference to the price of coal. But inasmuch as coal miners—for some not easily perceived reason—have been allowed for many years to consider their rates of pay as being far removed from the influence of the ordinary law of "supply and demand" that largely governs wages in other industries, and to consider themselves entitled to double pay for not a ha'porth more work (or care or diligence exercised in that work) if the price of coal is, by some means quite apart from the labour of getting it, temporarily doubled, no Conciliation Board in the coal trade to-day would exist a week if it tried to fix wages by reference to the general state of the labour market. If, then, Conciliation Boards are to be governed in their determinations by the price of coal, why not allow that price to be ascertained (as now) by independent auditors, and let wages automatically rise or fall according to their certificate? That is what we and the general public will want to know before lending any support to the movement by the Federation—we refuse to consider it a spontaneous movement by the miners against the sliding-scale.

Our columns have recently shown how unsatisfactory is the working of a Conciliation Board when wages are on the downward grade. When prices and wages are rising, everything is rosy; for the employers' side of the Board always loyally accepts the inevitable, and gives the men higher wages when the Board so rules. As soon, however, as the award is the other way about, we have strikes without notice by the pit "lads," which the Union takes little or no trouble to prevent or bring to an end, and which are still causing trouble in some districts; while the men generally grumble at the reduction as if they had never had an increase. The masters declare that their books show they are entitled to a reduction; the men deny it, and bad feeling is easily generated. Under a sliding-scale working, with an audit by third parties, there is no question about what price the owners have obtained, nor as to what the rate of wages shall be. It is, therefore, obvious that the sliding-scale system makes generally for peace and regular work in the coalfields, whereas a "Conciliation" Board system means constant uncertainty and frequent friction; and we believe the sole reason why the Federation prefers the latter is that, under the former, the *raison d'être* of the Union and its (paid) officials is by no means so obvious as under a system which, from the men's point of view, depends for its success upon the employers' fear of a strike. When a Conciliation Board is in operation, there is always a tendency for the men's leaders to "try it on," and see how far they can push the employers by working upon that fear. Such tactics sooner or later are overdone, and there is an explosion, causing heavy loss to all concerned, and to many who are not. So far as we can see, the sliding-scale has made decidedly for peace and friendly relations in Wales, and is opposed by the Union for that very reason; while the Conciliation Board in England has not yet earned such a verdict in a time of depression, nor given grounds for hoping that it will. We, therefore, trust that the employers in Wales will think well before they allow the sliding-scale to be abolished, though if they refuse we may possibly have a struggle of some magnitude, causing dislocation to the coal trade in the spring.

Gas and the Metric System.

THIS is the season of the year when the old controversy over the asserted advantageousness for this country of the adoption of the metric system of weights and measures usually crops up again, with the invariable result of leaving the matter where it was before. The autumn meetings of more or less scientific societies are coming on, and a number of resolutions favourable to the change are sure to be passed, according to custom. Meanwhile, we have not yet received an answer to the question put in these columns some time ago, as to how increases or reductions in the price of gas of a penny or two per 1000 cubic feet could be translated into their metric equivalents. It is a curious reflection how mankind becomes provided with units and systems of measurement. Sometimes this is an effect of chance; more often it is the result of the unconscious selection of what is convenient; rarely it is brought about deliberately for reasons of a theoretical order. It has often been remarked here that the common agreement of the English-speaking people to price gas at so much per 1000 cubic feet is to be regretted for some reasons. It probably came about without much premeditation, upon the introduction of the consumer's meter; and the consideration that the amounts of the half-yearly gas bills then customary compared fairly with the older rental charges, would smooth the way of the new system. The unit of quantity is rather large; and it unquestionably had a certain influence in causing gas to be regarded as a luxury, or at any rate as a costly commodity. An article which is priced by the 5s. worth, or thereabouts, looks like that. When gas went on the Continent, it found the metric system before it, at least in legal possession of the Latin nations and some others; and gas was just the commodity to be sold by the cubic metre, which only ran to a few small coins in value. It was always dear at that; but it did not look so to the inexperienced public. The impression of cheapness was also favoured by the custom of monthly collections. There is much more in these appearances than the severe economist of the study is usually willing to admit.

As experience accumulated and time went on, the rigidity of the metric measurement of gas and the decimal coinage prices that go with it became apparent. A good deal of the endless squabbling between some Continental Gas Companies and Municipalities is directly traceable to this rigidity, which amounts to cumbrousness, and is a hindrance to economic adjustments of values. The original pricing of gas by the cubic metre in centimes or their analogues is very simple and plain and symmetrical. The awkwardness appears when the question of alteration of price arises. In Paris, they have a splendidly logical system of inquiry by official Commission when such alteration should be made,

with the result that there has been no change for fifty years. In these circumstances, a technical periodical once took occasion to utter the gibe that all the progress of the gas industry for the past half century could not amount to much, seeing that it had not been judged adequate to cheapen the production of gas by "one sou" per cubic metre! The obvious rejoinder was a reminder that the amount mentioned is really large—a sou, or 5 centimes, per cubic metre, although the value of the smallest coin in common use, is equivalent to 1s. 1½d. per 1000 cubic feet. Thus the metric system of gas measurement does not lend itself to those small adjustments of selling price to working expenses which are the life of a competitive business.

Those who advocate the change to the metric system of weights and measures for the United Kingdom are generally men of the chemical laboratory and the study, not of the market-place and the shop. They forget Sir Frederick Bramwell's unanswered objection, that mental arithmetic is impossible by decimals. They are fond of poking fun at the "barley-corns" and other archaic terms which lie at the root of the Imperial system; but they overlook the enormous volume of the business that is done in "unscientific" measures which will never be changed—such as the wonderful units and multiples employed in the printing and paper trades. What, also, of the sizes of roofing slates, bricks, and a host of other indispensable commodities made to dimensions prescribed by convenience or tradition? What have the metrists to say of a barrel of beer and its subdivisions? or would they rob the meat trade of its "stones," so handy for "lightning" calculations? Let them get a resolution in favour of the metric system passed in full market anywhere, and it will carry more weight than anything done in the cloistered calm of a British Association sectional meeting.

A New Style of City Life.

An intelligent appreciation of the trend of human affairs is notoriously one of the contributories to business success. It behoves those who have the conduct of any large industrial or commercial undertaking to be continually alive to any change of externals which may possibly affect the course of their trade. The constant appearance of new firms in the industrial firmament is to some extent a sign that the old ones are commonly subject to the weakness of letting things slide. All firms grow old, if they live long enough; and it is a matter of general observation that as they increase in wealth and in length of days, they not infrequently fall into mercenary or merely weak hands, which take the profits that accrue, and are heedless of signs of impending changes outside which may eventually favour rivals and sap their own existence. The history of the gas industry is full of illustrations of this kind of thing. Time and again, capable men in different branches of the industry have perceived what was worth going for, and have shaped their course accordingly. We are not alluding here to the actual origination of novelties from within, but to the timely recognition of the way in which the wind was springing up outside, bringing fresh possibilities of advantage to those who could trim their sails accordingly. For lack of this perceptive power, old undertakings and firms lie wallowing in the trough of a cross sea, either making no headway or being actually driven backward, until perhaps after a severe punishment they contrive to haul round—in time, indeed, to save themselves, but only to see others which were more smartly handled far ahead of them.

The hired-out gas-stove, the practicable gas-engine, the passable gas-fire, the popular prepayment meter, the incandescent burner—these have been in turn so many invitations directly addressed to gas companies to try their fortune along fresh lines. Many did so, with more or less alacrity and aptitude; and they have experienced various degrees of success from their endeavours. Some never did. Others could not see their way to making a new departure until years after everybody else had taken to it; and these suffer accordingly—or they will do in the fulness of time. We have often urged upon the attention of those who are responsible, not only for the present well-being, but also for the future prosperity of the gas industry, the necessity of keeping the track of such outside matters as the housing question. It should not be the fault of the gas people concerned, whether company or municipal, if the gas-light and the gas-stove do not fill their part in the better housing of the poorer classes of the community upon which the conscience of our rulers appears to be made up. As regards the present style of "flat" dwellings for the better-class town dwellers, gas has largely been left out of sight. This should be repaired, as opportunities for doing so present themselves. As regards the future, the possibility that the American fashion of huge, towering, self-contained town houses will spread, contains much possibility for gas, which, however, will require looking after if it is not to be let slip. There arises from the contemplation of this fashion in building, a curious reflection on the trick of repeating itself so noticeable in humanity. Once upon a time, the citizen lived over his shop. Then he left the city for the suburbs, and nobody but the caretaker dwelt at the place of business. Now it appears as if the older fashion were about to return, with the slight difference of a few storeys in height above the ground. There is much to be said in favour of the revival.

Close of the Latest Salford Corporation "Scandal."

A distinctly unlovely side of municipal trading is displayed in the proceedings at Salford in respect to the allegations made with regard to the conduct of the electricity supply undertaking of the Corporation. It is all very well for superior persons to write papers and magazine articles in praise of the principle of municipal trading; but in practice municipal business of every kind is subject to a variety of troubles of which such writers appear to be profoundly ignorant. Prominent among these is the ever-recurring imputation of personal corruption, or at least interested wire-pulling, which is always waiting to be fastened upon any and every person who becomes notorious for his share in the control of local public affairs. There exists in all communities a set of sour and suspicious people always predisposed to ascribe bad motives to, and place the worst interpretation upon, the activity of public characters. So common and well-known is this phenomenon, that it constitutes one of the deterrent influences against participation in local politics which act most strongly in keeping out of public life the very men who, by their ability, character, and position, should held to adorn it. This being a matter of general observation, those who best know the facts are the first to admit that every addition to the financial and industrial activities of local authorities tends to increase the danger of frightening off the most eligible candidates for election to the onerous and thankless distinction of membership. On the other hand, there is the real risk of misdirection of administrative powers where these fall into unworthy hands. At Salford, certain matters in connection with the Corporation electricity undertaking which need not be particularized here, led to charges of fraud, ill-doing, and the use of undue influence against certain members and ex-members of the Town Council. An investigation into these charges was made by Judge Parry, of the Salford County Court, with the gratifying result that they were all dismissed as unfounded.

One of the complainants who had been most officious in stirring up this affair was Mr. W. Hunt, one of the Elective Auditors of the borough, who asserted the principle that "a councillor must not trade with another person who "is doing trade with the corporation." Judge Parry has remarked upon this proposition that it is certainly not the law, nor, in his opinion, is it a sensible suggestion to put forward. If it were allowed to prevail, either trade would be paralyzed, or a municipal council must consist solely of those undesirables who have no trade, occupapation, business, or profession. His Honour put the law very plainly thus: "A councillor is not fettered in carry-"ing on his ordinary business in his ordinary way, or "in trading with persons who trade with the corpora-"tion. He may sell where he pleases; and that the "person to whom he sells is a trader with his corporation "is of no importance." Even if the things he sells come to be resold to the corporation, this does not matter, so long as the first sale was genuine. A councillor must not, however, enter into a contract with his corporation directly or through an intermediary, wholly or in part. He is in a position of trust, and is chargeable with reasonable inquiry to discover whether he is trading with his corporation through some other firm; for that is clearly forbidden. An honest man may, by carelessness or mistake, find himself trading with his corporation; but there need be no reason, with ordinary care, why such a thing should take place. "No "amount of ingenuity, however, in the form and manner of "sales, can assist a dishonest man who tries to evade the law." The foregoing observations apply to ordinary commercial

dealings; statutory supplies are, of course, provided for by the statutes relating to them.

In commending the Judge's report to the Council, the Mayor remarked that he hoped it would "clear the air." Meanwhile it is not pleasant to hear that the matter has caused the resignation of about half-a-dozen gentlemen who were rendering valuable service to the town, and had also prevented other good men from entering the Council. That is the point. How is the business of such a Corporation to be carried on? It is a difficult question to answer; because, after the air has been cleared of all foul suspicions of councillors' personal rectitude, the point of efficiency remains. Trade, deprived of the safeguard of the only absolute test of efficiency, can never give a convincing account of itself.

Autumn Meeting of the Institution of Gas Engineers.

When the Institution visited Cambridge at the close of their annual meeting in May, the President (Mr. T. Holgate M.Inst.C.E., Engineer of the Halifax Corporation Gas-Works) made a general forecast of the proposals for the autumn meeting. This we published at the time, and now, through the courtesy of the Honorary Secretary (Mr. J. W. Helps), have the confirmation and details of the arrangements. Halifax is to be visited; and the engagement will extend over Thursday and Friday, Sept. 11 and 12. The round of events will commence, at 2.30 on the Thursday, with a reception by the Mayor and the Gas Committee at the gas-works, where light refreshments will be served. Then will follow an inspection of the gas-works, tar-works, and, if time permits, of the electricity works. At 6.30 in the evening, the members will be entertained at dinner by the Corporation in the banqueting hall of Bankfield. At this function, the Chairman of the Gas Committee will preside. Next day, they will leave Halifax by electric car for Hebden Bridge, thence by waggonettes to the Walshaw Dean reservoirs, now being constructed for the Halifax Corporation by Messrs. G. H. Hill and Son, MM.Inst.C.E. The drive will be through the beautiful woods of Hardcastle Craggs, by permission of W. Lipscomb, Esq., Agent for Lord Saville. Light refreshments will be provided, and then an inspection made of the three reservoirs. The return will be by waggonettes to Hebden Bridge; and here lunch will be served in time to enable the visitors to join the 4.26 train for London or the 4.17 train for Manchester.

Electricity Stimulates Gas Consumption in Liverpool.

It was unfortunate that, owing to illness, Sir Edward Lawrence was unable to preside at the half-yearly meeting of the Liverpool United Gas Company last Tuesday, as his remarks in emphasizing the principal features of the Directors' report, and on the progress and position of the Company, are always interesting to listen to. It was rather singular, too, that his place could not be taken by the Vice-Chairman, who was in Ireland. However, Mr. Lister, who presided, had a very good report to submit for adoption, and only a few observations upon it were needed. He said it was the best the Company had had for many years. During the twelvemonth ending June 30 there had been an increase to the extent of 3 per cent. in the consumption of gas, notwithstanding the competition of the electric light; and since June this had been further improved upon, so that it was now 4½ per cent. This was a clear proof that the electric light was beneficial, rather than detrimental, to gas companies, by stimulating a desire on the part of the public to use more gas in order to have greater illumination. As the Directors have seen their way to reduce the price 3d. per 1000 cubic feet, the consumers will have a strong inducement to gratify this desire. While they have been studied, the proprietors have not been made to suffer. They take dividends of 5 and 3½ per cent. for the six months ending June, and have the assurance of a continued successful career for the Company.

A Profitable Year's Working at Goole.

In the "JOURNAL" last week (p. 520), a paragraph appeared under the heading of "Goole Gas and Water Finances," in which it was stated, on the authority of the "Hull News," that the working of the Gas and Water Department of the Goole Urban District Council in the twelve months ending March 31 last had resulted in a deficit of something over £1000. The assertion was promptly contradicted in that paper by the Chairman of the Gas and Water Committee; and we regret that our attention was not called to the contradiction as it was to the original statement. At the meeting of the Committee on Monday last week, from which, unfortunately, the Chairman was absent, Mr. Jackson condemned in strong language the circulation of the report. Their version of the matter is fully borne out by the statistics prepared by the Clerk to the Council, which show a profit of £1150 18s. Further evidence of the year having been a very good one is afforded by the figures in regard to the working submitted to the Committee by the Engineer and Manager (Mr. Matt. Dunn), some selections from which will be found elsewhere. We are therefore the more regretful at being inadvertently led into giving additional currency to a statement so entirely without foundation. We are pleased to record that Mr. Dunn is relinquishing under very satisfactory conditions the management of the works he has conducted with ability since he was entrusted with the control of them early in 1898.

The Circular Inquiry Nuisance.

In dealing with this subject on previous occasions, we have admitted that there is information that cannot be obtained without writing to (say) one or two personal friends, but that there is no justification even among personal friends for taking an undue advantage in this respect of the relationship. As has also been pointed out, there are inquiry circulars that can be countenanced, much as they are abominated as a class. But the bulk of such circulars, affecting and attacking as they do the dignity of the engineering profession, cannot be tolerated by its better-class members. A circular of the latter kind has been sent out by the Town Clerk of Saltcoats. It is carefully drawn up, docketted on the back, and printed on blue foolscap paper—all of which discloses the legal hand. The fact that it is printed speaks of a large circulation. The document contains no less than twenty-eight questions, very few of which could be answered off-hand. Generally speaking, their object is to gain particulars from the source addressed as to the supply of water outside the borough, but within the limits of compulsory supply, and as to the supply beyond such limits. Reading through the inquiries, it is easy to see that what the canny members of the Saltcoats Town Council want to do, through the Town Clerk and the circular, is to get, at the moderate expense of printing and postage, information for their guidance in the management of their water undertaking, which they could obtain, in a simpler but perhaps rather more expensive manner, by consulting an engineer qualified to advise them. Unwittingly, perhaps, the Town Clerk of Saltcoats addressed a copy of the circular to a Consulting Engineer, who, if he had done the proper thing, would have returned it with a note mentioning the fee at which he would have been prepared to advise them; but instead he forwarded it to the "JOURNAL" offices as a sample of unwarrantable obtrusion. It would be interesting to know how many of these circulars the Town Clerk of Saltcoats sent out, and how many water engineers were foolish enough to answer anything like all the questions.

The Men Who Keep the System Alive.

The war which has been waged against this circular inquiry plague from time to time in these columns, we hope, has had at least some effect in mitigating it, and so relieved in a measure many of our readers from the vexation it causes. The system, however, is not dead; and we are afraid life never will be entirely squeezed out of it while there are engineers and managers who are foolish enough to pay attention to the inquiries sent them. Most of those who do so are moved by the idea that they are doing a kindly act; and others who make some sort of reply are the men who are glad enough at times to use the same channel to procure information "on the cheap," or to make good their own deficiencies in knowledge. The man who thinks he is doing a kindness by answering these circulars takes a wrong view. As a matter of fact, he is doing, in every circular he replies to, an injury to his own profession. He is assisting in keeping alive a system that gives annoyance to the bulk of his professional *confrères*, and that has for its object the obtaining of counsel that should be paid for in the proper way. The support of the nuisance by an engineer is parallel to a hard-working man giving alms to an able-bodied

and lazy beggar. In the case of the men who reply to these circulars as a reciprocal obligation, because they are glad enough to take advantage of it themselves on occasion, let us point out to them that the sooner they give up the practice, the sooner will they cease announcing to other members of the profession their own shortcomings, and so be consulting their own dignity. To beg most men are ashamed; and those who do so are not respected any more by their fellows for being a nuisance to them.

Faultless Electricity!

Mr. H. C. Marillier, who is a gentleman of whom we have not heard before as a judge of the fitness of methods of lighting for particular applications, has been writing in the "Pall Mall Magazine" on the "Electric Lighting of St. Paul's." In a measure, the article is interesting; but, as one reads, he is impelled to the conclusion that the author knows just about as much of his subject as he has been told. "St. Paul's Cathedral and electric light! What is there," he asks, "in the association which produces a passing sense of incongruity? Perhaps it is a back-wash from the lately spent conflict between science and religion, now externally the best of friends; perhaps an instinct (which one could sometimes wish were more general) that it is desecrating to impose the modern upon the ancient, to put a new patch upon an old garment, as the parable says. Actually there is less cause for sentiment on this ground in the case of St. Paul's than there would be, for instance, in the case of Winchester or Canterbury; for St. Paul's is more truly a modern than an ancient building. . . . Even had it been otherwise the recent transformation of the interior from surfaces of plain stone to the glowing splendour of colours and gold sufficiently prepares us for further innovations; and, as a matter of fact, the question of electric lighting synchronizes with, and is dependent on, this question of decoration, for by no other means could the work be expected to retain its quality and freshness. Gas is a notorious destroyer of fair surfaces; and, after all, when one comes to think of it, the taint of modernity rests quite as distinctively upon gas as upon electric light. And with considerably greater reason; for gas is dirty, and defies artistic treatment, whereas electric light is a clean and civilized thing, and may be (though it too often is not) adapted to almost any requirements of style and taste."

Electrical Fables.

In the latter part of the foregoing quotation, we have the best of grounds for complaint against Mr. Marillier, because it proves that he is writing without a knowledge of what the latest scientific researches into this matter have proved to the world. "Gas is a notorious destroyer of fair surfaces." This depends entirely on the manner in which the gas is used. And if Mr. Marillier will only take the trouble to peruse Dr. Percy Frankland's recent report on his investigations into the lighting of picture galleries, he will find that someone besides himself has pronounced an opinion on this very point, and that it is an opinion which transcends in its authority anything that Mr. Marillier can say on the subject. "Gas is dirty." That again depends upon the manner in which it is used. It "defies artistic treatment." Well, here we pity the writer's want of knowledge on up-to-date incandescent gas lighting. Then the electric light is "a civilized thing." With due deference, we beg to say that our observations have given us a different impression. We can call to mind, without reference to the "JOURNAL" records, certain barbaric performances of electricity. Several uncomfortable upheavals of roads occur to us, some disastrous fires, and a number of "ghastly" cases of fusion of gas-pipes (all of which have menaced life and property), to say nothing of the strange way this "civilized thing" has of plunging an assembly of friendly people into darkness. Later on in the article, the writer tells us that the burden of expense for installing the light in the Cathedral has already proved a heavy one, and the end is not yet. Up to the present, nearly £10,000 has been spent on it, and possibly £2000 more will be needed. We undertake to say that for several thousands less than this, gas lighting engineers would have been glad to have installed the civilized and scientific system of incandescent gas lighting, and in a manner that would not have destroyed the internal "fair surfaces" of the grand edifice. The money wasted over this lighting might have been devoted to some better object.

The British Association in Belfast.

The British Association meets this year in Belfast, under the presidency of Professor James Dewar, F.R.S., who is expected to devote his address to his own speciality of physical chemistry. Professor Dewar has taken an active part in gas matters for many years past, and his address can scarcely be otherwise than replete with interest for followers of the gas industry. So far as the general business of the meeting is concerned, there is no promise of anything "sensational" being made public at Belfast. A complete lull seems to have overtaken the world of science in respect of new discoveries; although, of course, the further elucidation and consolidation of known truths is always going on. Most of the sections will deal pretty largely with Irish subjects. Professor John Perry, who will preside over the Engineering Section, will have a grand opportunity for expressing his views on the education and training of engineers. Among the papers to be read in the section occur one on the "Combustion of Bituminous Coal," by Mr. W. H. Boots; and one on "Recent Progress in Large Gas-Engines," by Mr. H. A. Humphrey. The Friday evening discourse will be by Professor J. J. Thomson, F.R.S., on Becquerel rays and radio-activity, concerning which all those who are specially interested in matters connected with lighting must entertain a high degree of curiosity.

WATER AFFAIRS.

The Control of Water by the State.

THE ancient city of Exeter having been selected for holding the Annual Congress of the Royal Institute of Public Health, there was a certain fitness in the selection of the Earl of Iddesleigh as the President. Associated as his family have been for many years with Devonshire's historic capital, it was only to be expected that a Stafford Northcote should occupy a conspicuous place at such a gathering as that which took place in the Victoria Hall last Thursday morning. But there was another reason which marked his Lordship as a suitable President of a congress on public health. He is not only an authority on hygiene, but he has taken (as the Mayor informed the audience in introducing him) a lifelong interest in matters pertaining to the health of the people. Moreover, he is Chairman of the Royal Commission on Sewage Disposal; and the city has of late attracted considerable attention for the adoption, as the result of the untiring energy and ability of Mr. Cameron, the late City Surveyor, of the septic-tank system. It was therefore perfectly in keeping for his Lordship to refer, in his Inaugural Address, to the work of his Commission, as recorded in their published reports. He paid a high tribute of respect to Manchester and Leeds for the amount of public spirit they had displayed in endeavouring to solve the difficulties attendant upon any satisfactory system of sewage disposal.

Important, however, as this subject is, in connection with public health, his Lordship pointed out that there was a larger and more vital question still, of which it only formed a part, and to which he suggested that the serious consideration of his audience should be directed. Of course, he referred to the subject of the use and abuse of our water supply. He said he sometimes wondered whether the immense gravity of this matter is fully realized. We think that it is; but the whole question is surrounded with difficulties—not so much of an engineering as of an administrative character, as Mr. Percy Griffith has pointed out in the preface to his recently published book, noticed in the "JOURNAL" columns a few weeks ago. That is to say, associated with water supply there are so many different interests to be considered. Mr. Griffith sees a remedy for some of the existing troubles in the establishment of Water Boards, subject to the supervision of Parliament, the Local Government Board, and the Board of Trade. But Lord Iddesleigh clearly favours greater centralization of authority. He told his hearers that if he were an absolute Emperor he would constitute a Government Department to deal solely with the administration of water. This is not the first time the idea has been put forward. Dr. Percy Frankland made a somewhat similar suggestion at the meeting of the Institute two years ago; only he proposed a body constituted on the lines of the Massachusetts State Board of Health. His Lordship would

expect the new Department to be beneficial to the community partly by the wise exercise of its discretionary powers, but more especially by the knowledge it would gradually accumulate and place at the country's disposal. Certainly, there seems to be room for such a department to deal with water supply as a national question affecting the entire community. The business of a body thus constituted would be primarily to institute and carry out investigations with the view of acquiring exact knowledge on all subjects connected with water supply, and to exercise control over the various sources. In the absence of such knowledge, people are in perpetual danger, as Lord Iddesleigh pointed out, of indulging in recklessness on the one side or in fads on the other. Of these two dangers, he found it difficult to say which was the more formidable.

Preferential Rights to a Supply of Water.

An interesting legal point was raised in the action brought a few weeks ago (*ante*, p. 352) by certain mill occupiers on the banks of the Brow Grains Dike, at Meltham, against the Huddersfield Corporation, for failing to supply them with the compensation water granted to them for the loss of certain streams appropriated by the Corporation under their Act of 1869. The failure occurred last year in a time of abnormal drought; and the Corporation pleaded that the shortage of water which really caused it was due solely thereto. The plaintiffs, on the other hand, asserted that during the half year in which the drought occurred the Corporation sold upwards of 300 million gallons of water to manufacturers inside and outside the borough. The plaintiffs obtained the penalty of £5 a day which they claimed; but a stay of execution was granted pending an appeal. In the course of the proceedings, it was pointed out, on behalf of the defendants, that the question as to whether a corporation can cut off compensation water in order to supply the inhabitants of the town had never been decided. More will probably be heard of this matter; but, meanwhile, it may not be uninteresting to cite two cases, bearing to a certain extent upon the question, which have recently come before the United States Courts. According to particulars given in the "Engineering Record," the Supreme Court of Vermont granted an injunction to restrain the Barre Water Company from supplying water to certain granite-polishing works, on the ground that such supply diminished the flow to which the lower riparian proprietors were entitled. The Company were authorized to take the water needful for the use of the inhabitants of the town, "for the extinguishment of fires, and for "domestic, sanitary, and other purposes." The last two words were ruled by the Court to mean "other *like* pur- "poses;" and that the sale of water for manufacturing operations did not come within this definition. The other case came before the Supreme Court of Ohio. It was an action brought against the City of Canton (Ohio) by a lower riparian proprietor, who contended that the municipal authority had no right to supply water for manufacturing purposes when by so doing his privileges were interfered with. Here the Court decided that the City had a perfect right to provide for all the reasonable needs of manufacturers, in addition to the domestic requirements, within the municipal limits. It was held that the City was an "individual entity," endowed with all the rights and liabilities of a riparian owner. One of these rights was the reasonable use of water; and the Court came to the conclusion that the use of water for "any legitimate industrial purpose" was legally reasonable, and subject to but a single restriction—viz., the equitable division of the water, other than that required for domestic purposes, between all the riparian owners during periods of a scanty supply.

Cycling Accident to Mr. Richmond.—It was reported in last evening's papers that a Mr. Walter Richmond, "a gas engineer, of Birmingham," had met with a serious accident on Sunday while cycling from Land's End to Newquay to join his family. At first it was stated that he was dead; and later that he was in "an extremely critical condition and unconscious, but hopes were entertained that he would recover." The name and other circumstances suggested that it was Mr. E. W. T. Richmond, and on making inquiries of his Private Secretary at 132, Queen Victoria Street, E.C., we learnt that Mr. Richmond had met with a cycling accident at Porthcurno, near Treen, Cornwall; but he was disposed to think, from telephonic inquiries of the Plymouth branch office, that the occurrence was somewhat exaggerated by the London papers. We hope this may prove true.

ESSAYS AND REVIEWS.

THE TRANSITION OF MR. CHARLES HUNT.

AN APPRECIATION.

Restless time is constantly producing change—expected and unexpected—in the living and the inanimate world, and in a condition of things or of persons to which we have been accustomed, perhaps from childhood up, there comes a transition to which it is hard for one to become reconciled. This is the case with us, and will be with many more, in the removal of Mr. Charles Hunt from Birmingham. So long has his name been connected with the Windsor Street Gas-Works of that city that only time will enable us and others to become accustomed to the separation which will actually take place before another issue of the "Journal" is published. For thirty years have the names of Charles Hunt and Windsor Street Gas-Works been united; and during the whole of that time have Mr. Hunt's professional contemporaries looked to those works as one of the places wherein to obtain counsel, and the younger generation of gas engineers (to the length of their connection with the industry) have sought light and leading there, and have not sought in vain. But the time of severance has arrived; and, as already said, a period must elapse before Mr. Hunt's friends and the gas profession at large will familiarize themselves with the change. Happily, however, the change is only one in condition; and the gas industry will still continue to have at command the benefit of Mr. Hunt's ripe experience and sound judgment.

Although Mr. Hunt is quitting his official position under the Birmingham Corporation of his own accord, it is safe to say that he will not leave the Windsor Street Gas-Works without a wrench. No insinuation of an excess of sentimentalism can find place here. A man who has spent exactly one-half of his sixty years of life in one position; who in the early years of control of the works had to fight (and fought successfully be it said) with almost uncompromising conditions brought about by the violation of trust by a former official; who has replaced the old unpretentious works brick by brick, plate by plate, and column by column until now nothing but odds-and-ends remain to remind him of the works in which he began what must be the largest and most important chapter in his life's labour; who has extended the works until they are mammoth compared with what stood on a portion of the same site thirty years ago; and who has, as opportunity came for extensions, used his works to show and prove what was possible in the ways of economical construction and production—such a man, we say, could not leave the scene of so much work without a feeling of keen regret at the separation. Above all things during his chieftainship at Windsor Street, Mr. Hunt has proved himself a progressionist, and one whose forward movements have been made along a track laid in common sense. The Windsor Street Gas-Works have been, through their head, among the first to show that which has helped the gas industry to make such remarkable strides as it has done during the past two decades; and that is the possibility of (metaphorically speaking) making "two blades of grass grow where only one grew before." This is what Mr. Hunt has been doing during the latter half of his life. He has, in fact, been running close with Sir George Livesey in showing how to produce, store, and distribute gas more economically than aforetime. Herein and in the originality of idea, of plan, and of execution, which have been among the characteristics of his professional career, are to be found the grounds upon which Mr. Hunt has risen to the honoured position which he occupies in the ranks of the profession. His popularity, too, is largely due to the fact that he has never been an engineering anchorite. He has ever moved freely among his professional brethren, has given generously to the gas industry of the fruits of his talents, and has again and again proved his broad and active interest in all questions in which he saw the possibility of good for the gas industry. The Birmingham gas undertaking is losing a man whose services we do not hesitate to say the gas industry generally will hope to retain for many long years to come.

Early Days at Windsor Street.

The opportunity has never before arisen when we could write with such freedom of Mr. Hunt as we are now doing; and now that it has come, it is our intention to take a liberal advantage of it. So far, the opening paragraphs have been general in their character, and we will now endeavour to give something in the way of a narrative of his association with the Birmingham Gas-Works, following with an explanation of personal matters which have been of late the subjects of friendly chat in professional circles.

Few will remember Mr. Hunt before his advent in Birmingham. He was then Assistant Engineer of the late London Gaslight Company, which position, be it mentioned as a point of historical interest, he held from 1866 to 1872. At the time he was appointed to the position, he was under 24 years of age. It was in the year last mentioned that he was selected for the Chief Engineership of the late Birmingham Gaslight Company; and

for a man of thirty years of age, he must have possessed a robust courage to have undertaken such a position at such a critical time in the history of the concern. The Company was at that time, in truth, in very sorry circumstances, owing to the defalcations of the late Secretary (Mr. J. Harrison), who embezzled very large sums—in fact, so great were his peculations that there was little money for anything, and the consequence was that the works were starved. This, under ordinary circumstances, would have been a disadvantage; but the disadvantage was made the more dismal by the fact that, over nearly the whole of the district served by the Company, they were in competition with the Birmingham and Staffordshire Gas Company, who were better situated in regard to the obtaining of supplies. In the year 1846, when the Birmingham Company's works were established, there was no railway; and the canal was the means of communication to the only available coal-fields. The advisers to the Staffordshire Company, with discerning judgment, had established works at Saltley close to the railway, while the Birmingham Company—the works being located at a distance—had to cart their coal and other material from the railway, as little gas coal could be obtained by way of the canal in 1872. The extra cost thus incurred in manufacture seriously shackled the Company in effectually meeting their competitor. Before Mr. Hunt's time, several proposals had been made for altering the conditions of things by the erection of works near a railway, in order to extricate the Company from the "tight corner" in which it had been placed. But for one reason or another, they had all been shelved—mainly through the instrumentality of Mr. Harrison, who possessed great influence over the Directors, and whose opposition to the removal of the works was no doubt not altogether disassociated from his misdeeds, which had not then come to light. However, to make a long story short, the crash eventually came, and the Company found themselves *vis-à-vis* with a position of great gravity.

At this stage—1872—Mr. Hunt came on the scene, in succession to the Engineer, Mr. Edward White, who had resigned. The Company then, instead of paying their maximum dividends of 9 and 7½ per cent., were only declaring 5 per cent. on all classes of shares. But the calamitous position of things which the new Engineer found was soon changed. He first directed his attention to the works, with the result that he advised that a large expenditure on them was absolutely necessary. That this was essential was proved in the following year, when reconstruction of the plant was being actively pushed forward, in order to render it equal to the increasing consumption of gas. As a consequence, the next year was not financially a good one. But this was a case which could only be dealt with courageously and firmly, and a case in which it was condition precedent to the earning of money that money should be spent. At the same time, Mr. Hunt advised the Directors to look out for a site where works could be advantageously placed. In the year that he entered upon his work at Windsor Street, the whole of the authorized share capital of the Company had been called up, and only £15,900 of the loan capital remained. This sum the shareholders that year empowered the Directors to borrow. Under all the circumstances, an application to Parliament was inevitable; and in 1874, a Bill was promoted.

Reversal of the Companies' Financial Positions—From Company to Municipal Control.

In the meantime, the Company settled upon a site for new gas-works at Nechells and Duddeston. This is an interesting fact; and that large gas-works at the present date should be in course of construction there, is a tribute to the soundness of Mr. Hunt's judgment and to his foresight nearly thirty years ago. The land was provisionally bought by the Company; and, as previously stated, Parliament was approached. The Bill then promoted was what really brought about the transfer of the gas undertakings to the Corporation. Mr. Joseph Chamberlain was that year the Mayor of Birmingham; and the suggestion was made to him that the time was opportune for the purchasing of the gas undertakings. Mr. Chamberlain went privately to the Directors of the Staffordshire Company, and got them to agree to sell on the basis of their maximum dividends being secured to them in perpetuity. In the same way, he privately interviewed the Directors of the Birmingham Company, and they also agreed—imprudently without consulting any one—to part with their undertaking for a lump sum.

A few weeks after this momentous step was taken, which eventually consolidated the privately owned undertakings into a single municipal concern, the accounts of the Birmingham Company were issued; and the financial positions of the two concerns were found to be reversed. We should pause here to state that, owing to the coal famine in 1873, both of the Companies had had to raise the price of gas. The cost of coal went up from about 9s. a ton to anything between 20s. and 30s., which was, if anything, worse than the late experience of the gas industry. The Birmingham Company, in those days, bought for nine months at the high price of about 22s.; and the Staffordshire Company paid for a portion of their supply much more. However, while the Staffordshire Company had in that and the succeeding half year to take large sums from their reserve in order to pay their dividends, the Birmingham Company made profit enough for their maximum, and eventually succeeded in discharging some back dividends. We state these matters in order to emphasize the fact that, before the transfer of the two gas undertakings to the Corporation, the Birmingham Company, although hampered in regard to their site, had been restored to a sound financial state. From a chaotic condition, need, and scant profitableness, they rose to prosperity; while their quondam prosperous rival had had a set-back, and had to draw a considerable sum from reserve, in order to make up their dividends. They had, in fact, been previously so successful that they rather scouted the idea of having to raise the price of gas to the extent suggested by the Birmingham Company, having great faith in their powers to run through the troublous time unscathed.

Now, what brought about this happy change in the affairs of the Birmingham Company? Only one answer can be found, and that is the appointment of the new Engineer. We look in vain in the records of the Company to trace anything to modify this answer. A man of strong will, of firm hand, of keen penetration was required; and that man fortunately was found in the Charles Hunt of thirty years ago. As we recognize this now, so the Directors of the Company recognized it at the time. By his work, he gained their confidence and appreciation; and no higher testimony of this could be found than in the short, but expressive paragraph with which they concluded their report on the operations of the Company during the second half of 1874. "Your Directors," they wrote, "desire to record their high appreciation of the skill and energy displayed by your Chief Engineer, Mr. Charles Hunt, to whose untiring exertions and sound judgment the present improved condition of the Company's affairs is largely due." These are the words of men who knew how true they were; and, it can be easily imagined what great value was set upon such a testimonial to hard and faithful work by Charles Hunt, then only in his 33rd year, and within three years of his appointment to a position which many men would have evaded.

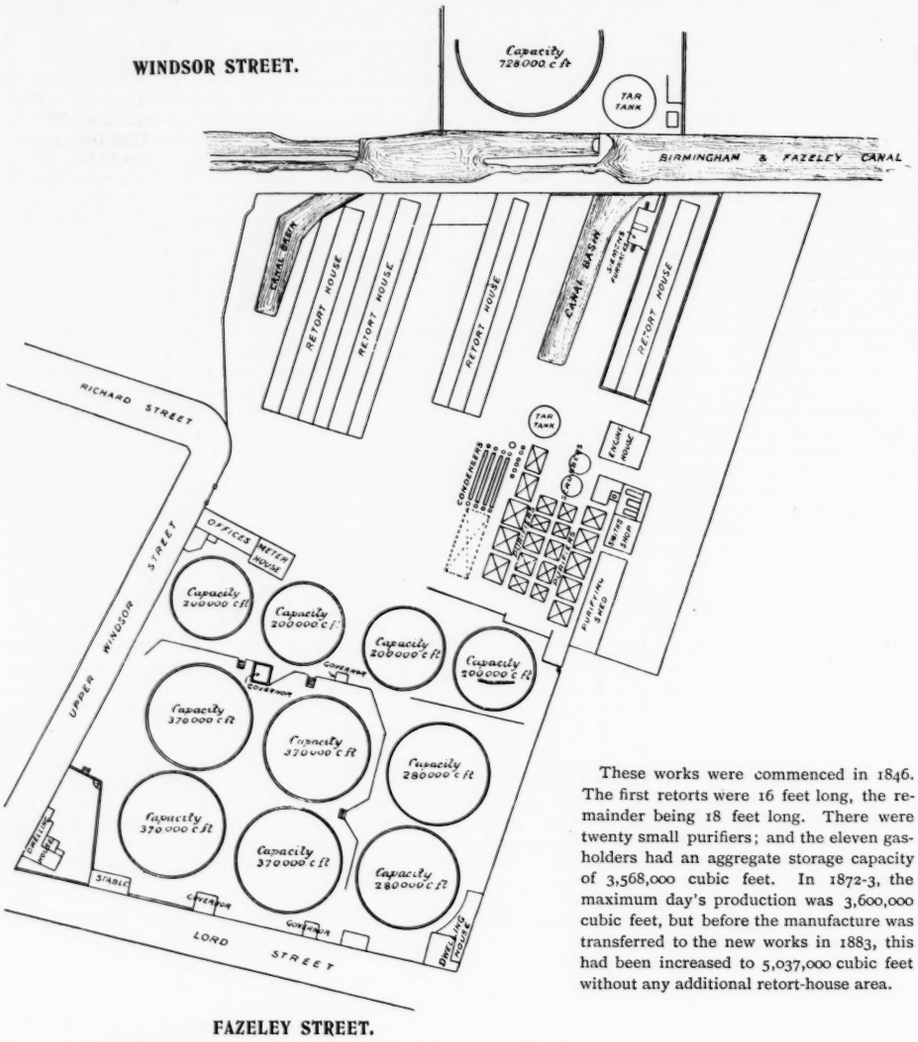
We may pass from this historical period in the history of the Birmingham gas undertaking by saying that, owing to the agreement to purchase and sell their works by the two Companies, the 1874 Bill of the Birmingham Company was withdrawn; but the necessities of the time compelled its renewal the following year, in order that the position of the concern should not be jeopardized in the event of the Purchase Bill promoted by the Corporation falling through. This, however, proved successful; and, as a result, the Birmingham Company's measure was dropped. Although Mr. Hunt was to a large extent concerned in this matter of the transfer, we need not give details respecting it in this sketch of his career in Birmingham—preferring to confine ourselves to the events more intimately associated with his personal work.

The Birmingham Company's Works as they were, and Windsor Street Works as they are.

When Mr. Hunt first became the Engineer to the Birmingham Gas Company, they possessed four establishments. There were the works on part of the present site at Windsor Street, and the stations at Fazeley Street, Gas Street, and Barn Street. But Windsor Street and Fazeley Street were the only two manufacturing stations; the other two being storage stations. At Gas Street there were three small gasholders, supplied by a 10-inch main from the Windsor Street Gas-Works. Barn Street was an adjunct of Fazeley Street, and was supplied from there. But at the time Mr. Hunt took charge, the gasholders for the Barn Street station were in a very bad condition; and one of his first acts—drastic measures leading to ultimate economy being the only sure means of dragging the concern from the evils which encompassed it—was to abandon these holders, and build stables on the site, so that the Company could in future do their own carting. This was carried out in 1873; the holders which were removed having a capacity of only 54,000 cubic feet. The storage station at Gas Street still remained; but there the gas accommodation was only equal to 100,000 cubic feet. At Windsor Street, however, there was storage capacity totalling to 3,568,000 cubic feet and at Fazeley Street a further 288,000 cubic feet. The existence of the Fazeley Street station continued until after the transfer to the Corporation.

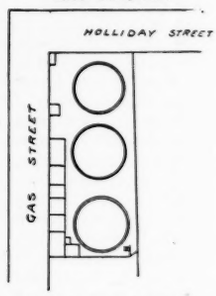
During the first winter that Mr. Hunt had charge of the Birmingham Company's works (1872-3), the greatest daily make, at Windsor Street and Fazeley Street combined, was 4,240,000 cubic feet. This, however, was not equal to the demand; and it was with the greatest difficulty that the winter was passed through—in fact on Christmas Eve, 1872, the holders were aground. The harassing condition of things with which he was surrounded in those stormful days, Mr. Hunt has since been able to look back upon with some equanimity; and we are inclined to the belief that the experiences in that veritable limbo—the struggles, the efforts to obtain an advantage over the difficulties, and their final outflanking—had in a measure the effect of early bringing out some of the strongest qualities of the Engineer whom we have since known and admired. However, the total production at the two works—Windsor Street and Fazeley Street—in the year 1872 was 794 million cubic feet. This, substituting Adderley Street for Fazeley Street, has in the last complete twelve months, reached the enormous total of 2,948,859,000 cubic feet, including 358 millions of carburetted water gas. This means that, during the time Mr. Hunt has presided at Windsor Street, the make under his charge has been almost quadrupled

BIRMINGHAM GASLIGHT COMPANY'S WORKS AS THEY EXISTED IN 1872.



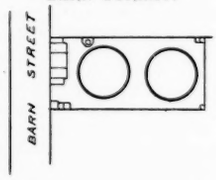
These works were commenced in 1846. The first retorts were 16 feet long, the remainder being 18 feet long. There were twenty small purifiers; and the eleven gasholders had an aggregate storage capacity of 3,568,000 cubic feet. In 1872-3, the maximum day's production was 3,600,000 cubic feet, but before the manufacture was transferred to the new works in 1883, this had been increased to 5,037,000 cubic feet without any additional retort-house area.

GAS STREET.



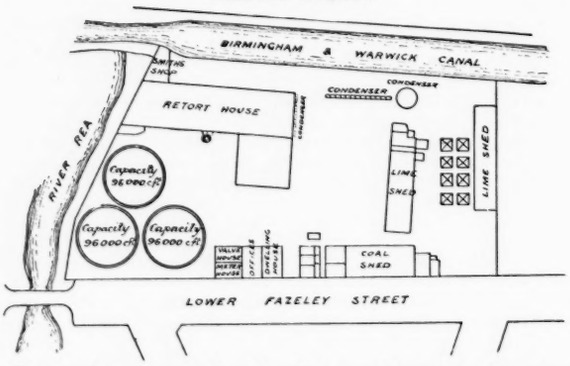
Here the first Birmingham Gas-Works were established in 1817 by John Gostling, who, in 1819, transferred them to the Birmingham Gaslight and Coke Company, which was in that year incorporated by Act of Parliament. Gas making was discontinued in 1850; but the gasholders, four in number, were continued in use. Three of these, as shown above, having a storage capacity of about 100,000 cubic feet, were still in use in 1872, being supplied from Windsor Street works, distant about 1¾ miles. They were taken out, and the site finally abandoned, in 1876.

BARN STREET.



These gasholders, erected in 1831, had a storage capacity of about 54,000 cubic feet. They were originally supplied from Gas Street works, distant about 1¾ miles, but afterwards became an adjunct to the neighbouring works at Fazeley Street. They were taken out in 1873, and stables erected on the site.

FAZELEY STREET.



These works were erected in 1836. They were dismantled and abandoned in 1876-7. The retorts were mostly 16 feet long. The maximum day's production in 1872-3 was 640,000 cubic feet. The storage capacity of the three gasholders was 288,000 cubic feet.

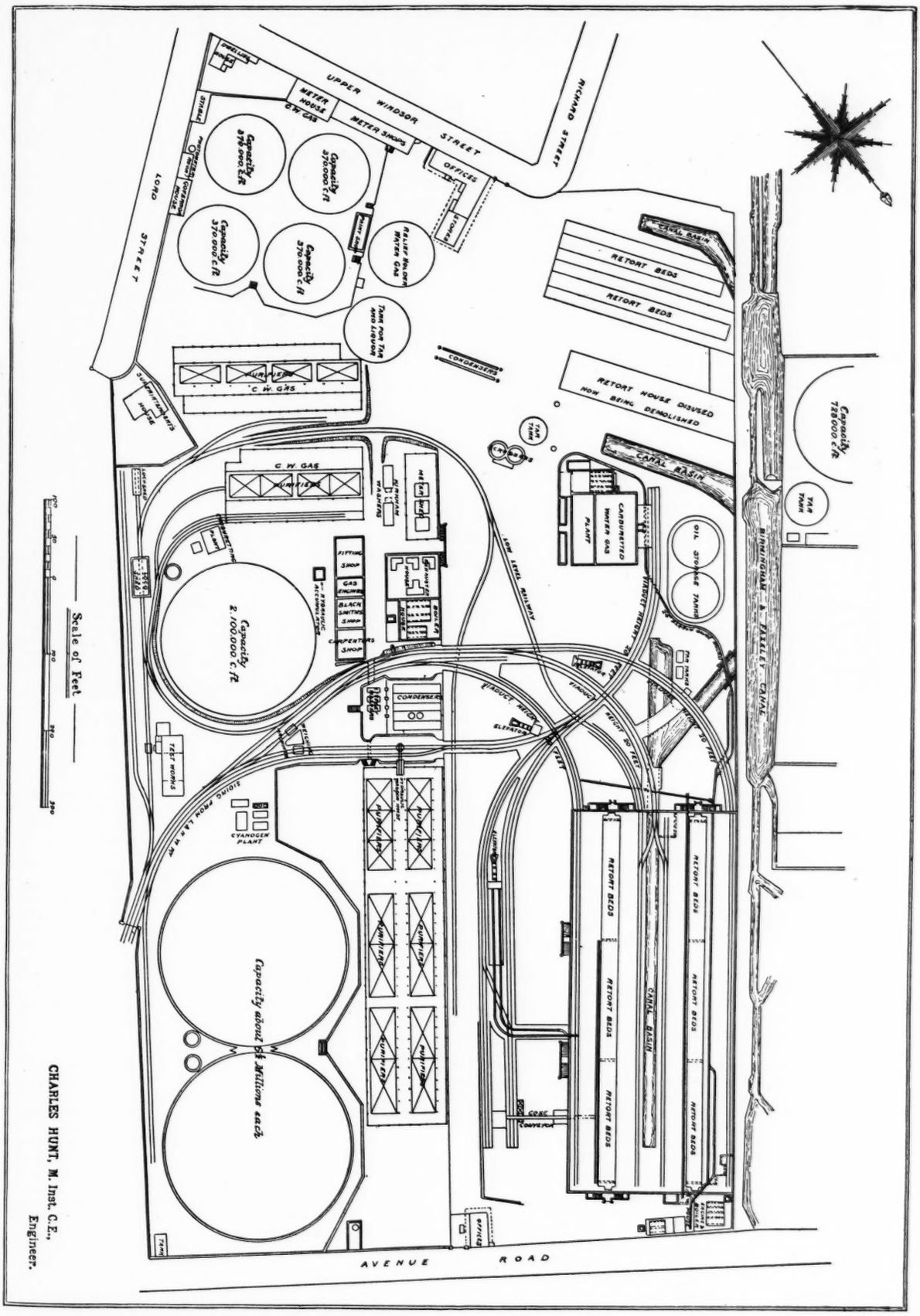
—at all events, it is now more than three-and-a-half times what it was when he entered the old works thirty years ago. When also we compare the greatest daily production at Windsor Street alone in 1872-3—viz., 3,600,000 cubic feet—with that of 1901-2, which was 12,203,000 cubic feet, we can realize, without further aids, something of the remarkable change that has in the meantime come over the face of the works.

This comparison has caused a little digression in our narrative; but the interest of the point is its justification. Following on the experiences of 1872-3, Mr. Hunt set to work to improve the carbonizing plant; and he was successful—by adding retorts to the settings, and by adopting larger sizes as the old retorts required renewal—in making the plant equal to the requirements of the succeeding winters. Another matter that engaged his serious attention in 1873 was the reorganization and betterment of the distribution system; and the records show that this work was not taken in hand before it was needed. The unaccounted-for gas in 1872 was no less than 12·071 per cent.; and no economist such as the subject of this biography had already proved himself could sit at ease confronted by such hideous waste. There was then a period of great activity in the streets of Birmingham. Gas-mains were re-arranged and overhauled, and services were liberally renewed, with the result that in 1875, it was found, to the gratification of the Engineer, that 6 per cent. had been knocked off the former ugly dissipation of gas.

Under the New Regime.

This question of the improvement in the distribution brings us to a point at which we can pass from the period of Company control of the gas supply of Birmingham to that of the Municipal management. With the transfer of the works, the Engineers of the two Companies went into the service of the Corporation; and here commenced the dual engineership on those lines of which Birmingham has been the solitary example in this country, and which has continued to the present time, but with Mr Hunt's retirement is now coming to an end. Mr. Henry Hack was the Engineer to the Staffordshire Company; and he has continued at Saltley ever since. Before the actual transfer, there was no understanding between the Engineers or with the Corporation regarding the future; and they appear to have gone into the Corporation service in a promiscuous kind of fashion—not knowing exactly what the future was going to bring forth for them, and not knowing definitely what lines the new administrators would take in allotting to them their respective duties. In fact, it seems to have been left largely to time and the course of events to bring about a settlement into positive channels of responsibility.

An example of our meaning is found in the steps which necessarily had to be taken to bring about, under the new order of things, the unification of the distribution systems. At the first meeting of the Corporation Committee which Mr. Hunt attended, he pointed out that the amalgamation and rearrangement of the distribution plant would, of course, have to engage their immediate attention. Mr. Chamberlain, who was then the Chairman of the Committee, concurred, and eventually Mr. Hunt was instructed to prepare a



PLAN OF THE WINDSOR STREET GAS-WORKS, BIRMINGHAM, AS THEY ARE TO-DAY.

CHARLES HUNT, M. Inst. C.E., Engineer.

scheme, and submit it to the Committee. This was done; and, after some consideration—the comprehensive character of the report meeting with the approval of the Committee—the whole work was handed over to him, and the distribution system has been (excepting, we believe, that portion served by the Swan Village works) his charge ever since. This decision involved him in the work of unifying, overhauling, and adjusting to the new conditions two separate systems, comprising over 500 miles of mains, much of which were in duplicate. The length taken up and relaid was over 100 miles, in addition to which several thousands of services were taken up or renewed. The work was heavy, and involved a great deal of nice discrimination and scheming; but eventually it was accomplished, and a large saving effected. At the time of the amalgamation, the unaccounted-for gas of the Staffordshire Company was fully 10 per cent., or only a little lower than that of the Birmingham

View (Taken during Construction) of the Large Retort-House at Windsor Street, showing Canal Basin running through Centre.

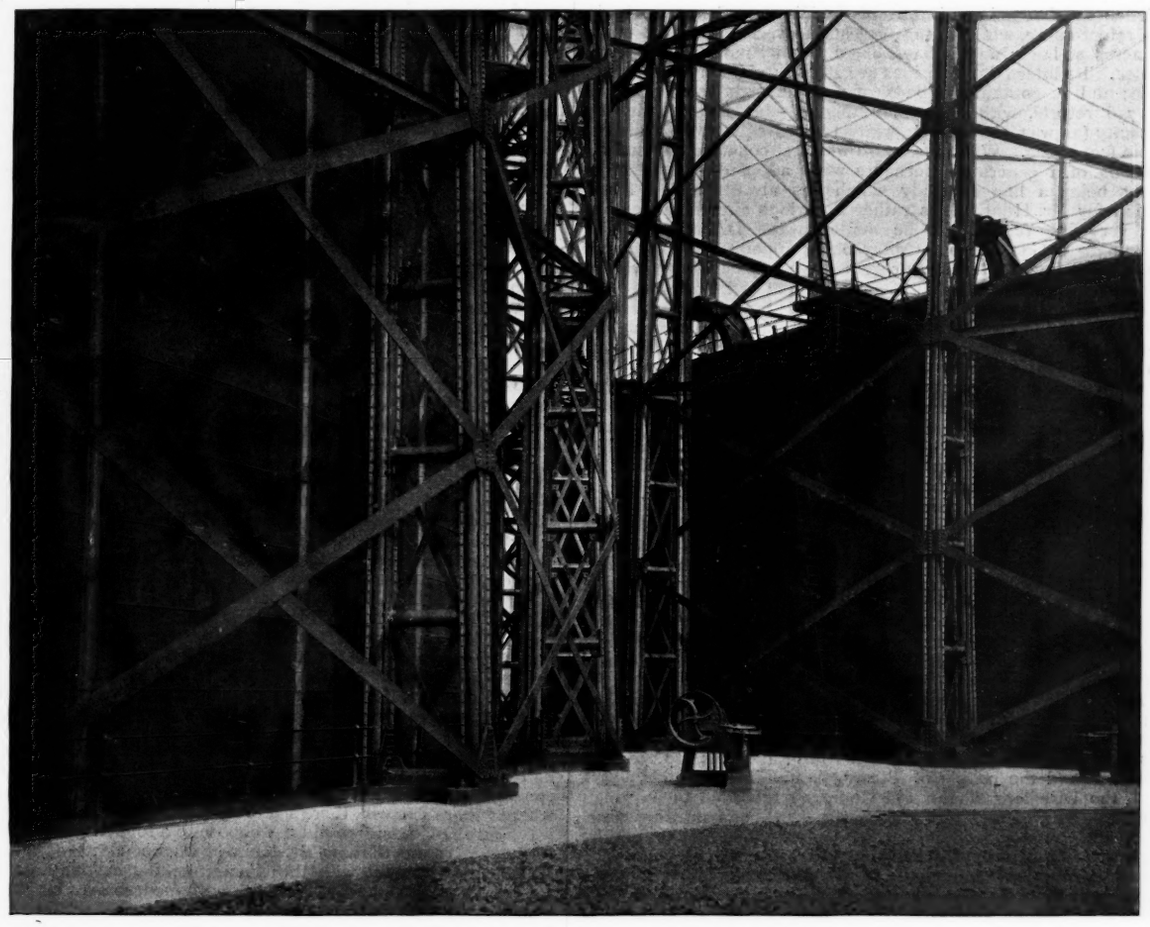
Company before the overhauling that Mr. Hunt gave their system soon after he first took charge. The result of the amalgamation and renovation of mains and pipes that took place under the large scheme after the transfer was that the unaccounted-for gas throughout the district was reduced, within a year or two, to 6 per cent.; and at about that figure it has remained to this day.

In another respect, too, the foresight of Mr. Hunt in those early years has had its influence on latter-day gas affairs in Birmingham. It will be remembered that mention has already been made of the fact that, before even transfer was thought of, the Birmingham Company had provisionally secured on his recommendation (which was confirmed by the late Mr. Thomas Hawksley, who was retained by the Birmingham Company for parliamentary purposes) the Nechells and Duddeston site for the purpose of constructing new gas-works in proximity to the railway. No sooner had the transfer become an accomplished fact, than Mr. Chamberlain, then the Chairman of the Gas Committee—recognizing the future importance of this land to the undertaking—clinched the bargain, and the Corporation became possessed of it. As is well known by professional readers, this is the land that adjoins the Saltley works, and on which the large extensions of the past few years have been and fresh ones are now being made. However, the land having been acquired, Mr. Hack had to take it into consideration in proposing his extensions at the time at Saltley. But it devolved upon Mr. Hunt to construct the gasholder which had then been decided upon as an adjunct to the Saltley works; and the position he chose for it forms the key of the plan that has since been followed in the development of the site.

Even then what Mr. Hunt's future was going to be in connection with the Birmingham gas undertaking was rather obscure; and, truth to tell, the then position was one which was sufficient to cause him some little anxiety. Had the Birmingham Company became possessed of the Nechells and Duddeston site, and had their Engineer's scheme for new works been actually in course of fulfilment before the transfer, the position would have been far different. But there he was in charge of works, the sites of which, on economical grounds, he had already condemned. The Windsor Street works could only be fed by cartage; and the whole of the land was exhausted. More could have been bought there; but that was not advisable in view of the distance from the railway. The Fazeley Street works he had also recommended should be abandoned; and the Gas Street station was already sentenced to demolition. We mention these matters as they eventually led up to the planting at Windsor Street of the huge works which have since grown there under Mr. Hunt's engineership. At that time even Mr. Hunt would have laughed to scorn a prediction that the works he is leaving at Windsor Street would have ever occupied the ground. However, looking to the future, he approached Mr. Chamberlain on the subject, and pointed out to him the unpleasant and somewhat critical position in which he was placed as the Engineer of works that were doomed to extinction in the natural order of things. Although no immediate satisfaction was obtained, it is plain that the matter did not escape the after-consideration of the Chairman, and that from this interview sprang greater things than at the time crossed the minds of either the interviewer or the interviewed. Soon after this, instructions were given to abandon and dismantle the Fazeley Street works; and the Adderley Street works, which formerly belonged to the Staffordshire Company, were given into Mr. Hunt's charge.

How the Windsor Street Site was Retained.

Shortly after the events just recorded, the first step was taken in that long chain of expansion that presents the Windsor Street works to us as we now see them. One day in 1876 or 1877—the incident is worth recording—Mr. Chamberlain was at the Windsor Street works, and looking over the fence at the adjoining land (which was occupied as market gardens and by squatters' hovels), he remarked "There is a lot of land here; I should like to have some of it." The desire was no sooner felt and expressed than it was realized; for he went straightway to the agents, and bought the whole tract of land lying between the works and Avenue Road and Rupert Street. Events followed in quick succession. The land purchased, Mr. Chamberlain was not long in setting Mr. Hunt to work. "You want more gasholder room," he said shortly afterwards, "take sufficient of this land for building a holder of the size of the one you have put up at Nechells." This was accordingly done; and here we have what was the beginning of the development of the new land. Then came the North-Western Railway Company, and made a suggestion, the value of which has been inestimable so far as these works are concerned. They proposed to Mr. Chamberlain that if he would let them have a portion of the newly-acquired land, they would carry the railway there. He made a deal with them, and realized a profit on the purchase. The portion of the land so sold adjoined Rupert Street, and was of least value for



THE TWIN GASHOLDERS AT THE WINDSOR STREET GAS-WORKS.

gas-works purposes. The Railway Company secured powers to construct a siding to the gas-works; and it was carried into them before 1880.

THE GREAT EXTENSION SCHEME.

This transaction made possible, and was really the origin of, the large new scheme of works at Windsor Street. Directly after the bargain was settled, the whole of the remainder of the newly-acquired land was handed over to Mr. Hunt, with instructions to prepare a scheme for its utilization. The scheme was prepared in due course, and submitted to the Committee, who were rather staggered by its extent. Even the projector himself was somewhat doubtful as to what would happen to it. But when we glance over the wonderful development that has taken place since then in the gas supply of Birmingham, the reality of the fact of how little the best of us can see into the future is forced upon us. However, new works were not required that year; but the consumption of the following one showed their immediate need. Then, on the suggestion of the Chairman of the Committee, a commencement was made with the scheme; but Mr. Chamberlain did not stay long enough in an official position to see its completion, for he soon after relinquished municipal work, and entered Parliament as one of the representatives for Birmingham—beginning that political career which has during the past few years been crowned by such great achievements for the whole country. He served Birmingham and the gas undertaking well; he has served his country better, and with more glorious issues. At the same time, Mr. Chamberlain still retains an interest—remote though it must necessarily be—in the gas-works which he took such a leading part in creating.

However, piecemeal, Mr. Hunt obtained authority to finish the scheme; and this was accomplished in 1885. Since then, of course, there have been several additions, including the 4 million cubic feet carburetted water-gas plant. But regarding them and the great scheme, we will not stay to give details here. A description and plans of the works were published in Vol. XLVII. of the "JOURNAL" at the time they were under construction, and afterwards in book form. Besides, Mr. Hunt has, at our request, prepared two interesting plans to accompany this record of his work in Birmingham; one showing Windsor Street as it existed at the time he took charge of the works thirty years ago, and the other as they stand to-day.

At the same time, there are a few points of general interest that may be touched upon. Mr. Hunt is a man of so many parts as a gas engineer and designer that it is difficult to say in which he excels most; but looking back over his career at Windsor Street, we think it may be said that the work which has the greatest attraction for fellow engineers is his gasholder and carbonizing structures. His "twin" holders are a feature of the works; their tanks being separated by a wall only 7 feet thick which is common to them both. As originally designed, these holders were not intended to rise more than two lifts. But while the matter was under consideration, Sir George Livesey's new 5¼ million cubic feet holder in the Old Kent Road had been put into operation; and, being anxious to take advantage of his opportunity to the fullest extent, Mr. Hunt managed to get his Committee to see the Old Kent Road structure while on a visit to the Crystal Palace Gas Exhibition. This prepared them for the suggestion which he afterwards made, that the Birmingham holders should be carried out on similar lines; and to this they consented. If they had not seen the Old Kent Road example, it is very possible they would not have so readily agreed.

These holders, with their capacity of 6½ million cubic feet each, were the largest in existence at the time; and it is believed that they still hold the premier position among twin holders. When we reflect on the stride in magnitude that was made by them, and that has since been made at the South Metropolitan Company's works and elsewhere, the development is really something to marvel at. In the year that Mr. Hunt first went to Windsor Street, there were eleven holders, the aggregate capacity of which was only a little over 3½ millions; and now he leaves the works with only eight holders (the older five of them small), the total capacity of which is 17 millions. When he put up the Nechells holder in 1876, he believes it was the largest out of London. Speaking of this large development of gasholders, there is a little story about the late Mr. Thomas Hawksley and Mr. Hunt, which is worth telling in this connection, and which reveals the inclination of the views of these two engineers on this question. It was at the time of the West Bromwich arbitration, and Mr. Hawksley was going round the Windsor Street works. The tank for the 2,100,000 cubic feet gasholder was then in progress. Noting its size, he observed to Mr. Hunt: "Too many eggs in one basket." Turning to the nest of small holders situated in what was then the opposite corner of the works, Mr. Hunt asked the veteran engineer, "But don't you think that here there are too many baskets for the eggs?" The development that has since taken place has proved the correctness of the insinuated view of the younger engineer.

Then another unique feature of the Windsor Street works is the retort-house, which is the largest in existence. It occupies 2¼ acres of land; and it has a canal basin running through its centre. Its internal dimensions are 487 ft. 10 in. long by 210 feet wide; and it contains 84 beds of nine through retorts, or in all 756 retorts, with 1512 mouthpieces—the daily producing capacity (as was proved last winter) being equal to 8¼ million cubic feet of gas. When the house was first constructed, various systems of regenerative furnaces were adopted—regenerative firing being a line of study which has always had a fascination for Mr. Hunt. It is rather a curious circumstance that the very first report that he made to the Directors of the Birmingham Gas Company after being appointed in 1872 was upon the Siemens alternating regenerative furnace which was in use at Windsor Street for heating six beds of eight retorts. The results obtained were not very encouraging; but he recommended a further trial of them with the addition of one retort to each bed—making them settings of nines. The system was finally abandoned in 1876; and very shortly afterwards, he inaugurated the present method of continuous regenerative heating by applying two furnaces at the Adderley Street works. These, it is noteworthy, were in use until the end of last winter, when they were pulled out, and have since been completely rebuilt. Consequently, on the success of this installation, Birmingham was the first to apply this system of heating on a large scale.

There are no other matters directly concerning the Windsor Street works upon which we need give information here. When Mr. Hunt entered them, they occupied an area of 9 acres; he leaves them in a few days with 26 acres well covered by mammoth plant. Of the old works that were there at the beginning of his thirty years' service in Birmingham, there are only five holders left, the then offices and meter-house (now converted into stores), and two old retort-houses, one of which is now being pulled down. It was built in 1846, has done good service, and has stood well the rough work of its fifty-five years of life.

As Mr. Hunt bids farewell to the works, into which he has put the best part of his life's work, he will be able to do so with the proud satisfaction that he leaves behind him a monument to his skill as an Engineer and to his faithful service to the Corporation and the people of Birmingham. Twenty-eight years ago, the Directors of the old Company recorded their "high appreciation" of his "skill and energy . . . . and untiring exertions and sound judgment." Had the same men had to-day the direction of the large establishment which the man of whom they wrote is now leaving behind, words must have failed them in giving adequate expression to their feelings. So far as we have been able to trace in the Birmingham press, the retirement of Mr. Hunt from Windsor Street (which is regarded as a great event in gas circles outside that city) has received no official recognition.

Rumours and Facts.

These last remarks bring us to a point at which we may refer to matters of a somewhat personal and delicate nature. So we describe them, as had not rumour winged them, with more or less exaggeration, throughout the profession, the matters in question would have remained private as between Mr. Hunt and all concerned in them in any way. But as they have been spread abroad, now is an opportune time to give the true version of the story, which has a connection with the retirement of Mr. Hunt from official service.

As report truly had it, last autumn Mr. Hunt was offered the position of Chief Engineer to the Gaslight and Coke Company. Although negotiations were not quite concluded, there was then every probability that he would have accepted the position, but for an unexpected obstacle. We say "unexpected" because after the many years of constant service Mr. Hunt had given in Birmingham, other treatment than he received might have been, and was, anticipated. It appeared, in short, that if he undertook the position at the time desired—merely a few months before the date at which he would have been entitled to his superannuation—he would have forfeited the latter. When the offer of the engineership was made to him by the Governor of the Gaslight and Coke Company, he at once explained his position in regard to this matter. An interview took place with the Governor, Sir John Aird, M.P., and Mr. Corbet Woodall, on Oct. 11 last—the very day a year later on which Mr. Hunt would have been entitled to his superannuation. At that interview, he asked what position the Company could place him in in regard to superannuation if he relinquished what he would be entitled to from the Corporation; and he was informed that he would have to begin *de novo*—that the Company could not take upon themselves the liabilities of the Corporation. Immediately Mr. Hunt took steps to ascertain what the Corporation would do in regard to the matter. He interviewed the Chairman of the Gas Committee, Mr. J. H. Lloyd (now the Lord Mayor), and a few days later he received from him a communication to the effect that the Committee had resolved that, in the event of Mr. Hunt resigning his position as from March 31, there should be paid to him out of the superannuation fund of 1876, or out of the fund to which he has in later years subscribed, a sum equal to his contributions to such funds, but *without* interest. It should be explained here that there are two superannuation funds—one known as the 1876 fund, and the other of more recent date. Mr. Hunt is not under the new scheme, which makes retirement compulsory at the age of 65. The old scheme contains no such condition; and therefore he could have remained in the Corporation service so long as health permitted. He had an alternative, however, and that was that he could, if he so desired, retire at the age of sixty, and be entitled to his superannuation. It is this condition of which he is availing himself.

Naturally, Mr. Hunt was surprised that, after having given to the Corporation what must be the best part of his life's work, to the best of his ability, and with the utmost faithfulness, such treatment and scant recognition should have been considered adequate. Better terms than were offered to him were conceded to every contributor of the old fund whether they fell into line with the new scheme when it was initiated, or were allowed to join it later on finding this to be to their advantage. In their case, the Committee recognized not the legal, but the moral claim; and, as Mr. Hunt put it to the Chairman, his moral claim was a much greater one than theirs. As a matter of fact, rather than accept the terms offered, involving as these did his remaining at Windsor Street until the end of the following March, it would have been better for Mr. Hunt to have gone to the Gaslight and Coke Company at the expiration of the ordinary notice, at the higher salary offered to him. Further correspondence and interviews took place; and then the Committee stretched their magnificent proposal to the extent of adding the interest. But even then—contributions and interest combined—this offer was only equal to about one-and-half years' annuity! Was this adequate after twenty-six years in the Corporation service? Mr. Hunt made a suggestion, as a way out of the difficulty, to the effect that they should grant him six months' leave of absence, or appoint him Consulting Engineer for six months, at any salary they liked to name, which would be returned to them if so desired. Even this reasonable proposal did not commend itself to the Committee. It is not suggested that they desired by their action to prevent Mr. Hunt accepting the chief engineership of the Gaslight and Coke Company; but that was its effect.

The idea of the Committee appeared to be that, as Mr. Hunt was not physically wrecked after his twenty-six years of service under the Corporation, and was able to take a higher position for perhaps a few years, that they should either have the full pound of flesh from him, or that he should forego the advantage that he had earned by long service. The Committee, in their correspondence, talked of not being able to exceed their powers; but where "there's a will, there's a way." Mr. Hunt pointed out a way, but the Committee did not choose to adopt it. The upshot of the matter was that, as Mr. Hunt could not arrive at a satisfactory arrangement with the Committee, the negotiations with the Gaslight and Coke Company were dropped, so as to leave both him and the Company unfettered. However, as he is now completing his final year of service, he will be able to claim the full amount of his superannuation; and what have the Committee gained? Absolutely nothing.

Looking at the matter from an independent standpoint, it does not seem that the Committee have been so gracious to their old official as they might have been; and they certainly have not dealt out to him any more consideration than if he had been one of the least useful of their servants. Not only might they have considered his long years of service, but there was the fact (which was well known to them, and which cannot have many parallels among gas undertakings) that his salary has remained stationary for fifteen years, during which period the output of gas from Windsor Street has nearly doubled, with its accompanying great increase of work in the distribution and meter departments. Treatment such as he has received is not likely to add to the popularity of service under the Birmingham Corporation, but, on the contrary, is more likely to do it harm.

This is, shortly told, the story about which rumour has been so busy during many months past. It is with sincere regret to us that it has been necessary to mention it; but it is a case in which the whole truth is better than the half. Now the facts are made public, many of Mr. Hunt's professional friends will share the sorrow that we feel that the last of thirty years' service in Birmingham, which should have been made for him the brightest one of all, has been overcast by the withholding of simple terms which would have given, without harm being done to anyone, a few months' desired relief. Dignity, kindliness, and generosity in this matter on the part of the Committee certainly do not find a place in the story.

The Future.

Regarding the future, Mr. Hunt has now definitely decided to devote himself to consulting practice at Westminster. During the time that he has been at Birmingham, many undertakings and local authorities have sought and benefited by his advice and assistance; and, as our columns bear witness, his name has been to the fore in several of the most important gas events during the past decade and more which have required in their solution the exercise of the best expert talent. Mr. Hunt's official connection with Windsor Street closes on Oct. 11; but actually it will end on Saturday next, when he commences his holidays. With him, he will take the best wishes of a host of admiring professional friends.

Contributions to Technical Literature and other Matters.

Though not directly connected with Mr. Hunt's work at Birmingham, no sketch of his professional career would be complete

without reference to his many valuable contributions to technical literature. Few men who have spent such a busy life in gas management and engineering work as Mr. Hunt have done so much as he, with his facile pen and pregnant brain, in adorning the written pages of the gas industry. More than two years before he went to Birmingham, while still in his twenties, we find that he was conducting some experiments on "The Ratio of Increase of the Illuminating Power of Coal Gas;" and these formed the basis of two extremely informative communications to the "JOURNAL" in 1870 and 1871, and brought the author into a discussion with no less an authority than the late Dr. Pole. It is interesting, at this time of day, and in the light of comparatively recent events, to read those articles. In exposing in them the fallacy alike of Farmer's theorem and Dr. Pole's law, Mr. Hunt was the first to demonstrate the inaccuracy of the standard burner when used for different qualities of gas, with a fixed, or the 5-feet, rate of consumption. Since then he has, at various times, advocated the use of the standard burner with a chimney full of flame; and it must be very gratifying to him to know that the principle for which he has long contended has to a certain extent been conceded by the Gas Referees, found a place two years ago in the South Metropolitan Bill, and is recognized to the fullest extent in the West Ham Gas Act this session.

Not many men, too, have supplied to the proceedings of the technical societies of the gas industry such an abundance of matter of the highest technical brilliance and substance as Mr. Hunt has done. Seven times has he occupied the presidential chairs of various technical societies; every occasion has yielded an address which scintillated with many bright thoughts on various topics; and each succeeding address has been enriched beyond its predecessor by the more ripened views of its author. To mention in chronological order the times he has been at the head of technical societies, we have to place in the forefront the Midland Association of Gas Managers, which he helped to inaugurate in 1877-8. In that year and the following one, he served as President. Then in two succeeding years—1880 and 1881—he was the President of the British Association of Gas Managers. From 1886-1888, he was Chairman of the Birmingham Section of the Society of Chemical Industry. The year 1892 found him at the head of the Institution of Gas Engineers; and the following year he presided over the Association of Birmingham Students of the Institution of Civil Engineers. The list is concluded most fittingly by the fact that he is, in this last year of his official connection with Birmingham, once more in the chair of the Midland Association. The address which he delivered to the members at their spring meeting, and its expansiveness of range and thought, will still be fresh in the memories of readers. It will be seen from this record that in very few years since 1878 has Mr. Hunt had rest from presidential duties, and this speaks louder than words of the great respect in which he is held both as a man and as a technician. To all the societies mentioned and others he has presented many contributions for discussion on several widely differing subjects. In connection with these communications, we may remind readers that, during Mr. Hunt's presidency of the British Association of Gas Managers in 1881, he was instrumental in initiating the Birmingham Medal, and was himself the worthy recipient of it in 1886. In addition to these addresses and papers, he is the author of the section on "Gas Lighting, &c.," forming the third volume of "Chemical Technology."

Beyond his written contributions to the literature of the gas profession, he has served the industry in other capacities—for example, he was Chairman of the Standards Committee, and of the Committee on the Influence of Temperature on the Registration of Gas at the Consumers' Meter. These Committees, it will be remembered, were appointed by the Institution of Gas Engineers. As a member of the Committee of the Crystal Palace Gas Exhibition of 1882-3, he also did useful service; and the same may be said of his work as a juror, with the late Mr. Robert Harris, of the Smoke Exhibition in the early eighties. The pages of the "JOURNAL," too, testify to the success with which he performed for some years the duties of Examiner in "Gas Manufacture" for the City and Guilds of London Institute.

Such a total of generous service to the industry will, we hold, find few equals.

THE QUESTION OF TAR.

THE stagnation of the chemical trade market for gas tar has naturally reawakened the interest of producers in the economic problem of otherwise disposing of it to better advantage. It has been a frequent topic of observation in the "JOURNAL," that all the triumphs of coal tar chemistry of which so much is heard from time to time have left the raw material at the same value that it had before such things were heard of. This result does not seem right, somehow. But the fact remains; and those who have tar to sell may be pardoned if they regard the price they are able to get for it as the most interesting thing about it. So far as can be gathered from the appearance of the chemical trade reports and prices current, it is only because tar is the source of pitch that it continues worth even so little as 1d. a gallon. There seems to be a good demand for pitch, chiefly on account of its being a necessary for the electrical road works that are going on so extensively just now; but how long this may last is questionable. Even so, the demand does not carry prices to such a profitable point as to make it worth while to keep in full work the products-recovery coke-ovens already built. If it had not been for the depression of the German iron industry, which caused many coke-ovens to stand idle, gas tar would have been further depreciated.

These considerations conspire to beget the suspicion in the minds of producers of gas tar, that they have little to hope for from the chemical trade demand. The question that arises for them in the circumstances is, therefore, what can best be done. The three main uses of coal tar are for distilling, for road making, and for burning. Of late years, the first of these has absorbed by far the largest quantity of tar sold off the works where it is produced; and it has consequently fixed the value. Burning tar has always been esteemed the last resource of the maker for getting rid of it; and the proceeding is often stigmatized as a waste of a substance susceptible of better usage. But the point of equivalent values settles the economic question. Tar is worth, to burn, what it saves in other fuel, subject to all the incidental considerations pertinent to the comparison. What these are is not at all times and in all cases easy to formulate. Sir George Livesey, for example, has long been in favour of burning tar when the distillers will not pay more than the actually ruling prices for it, with the express purpose of making them raise their offers. But this idea has been contemned in some quarters as chimerical, and also as an offence against economic law. The real objection appears to be that, supposing the plan to work, the effect would at best be "as broad as it is long;" while the balance must be difficult to keep, for the reason that producers who burnt the half of their make to-day might throw the whole upon the market to-morrow. That is to say, assuming the consequence of burning one-half of the output of tar selling at 1d. per gallon to be the raising of the market value of the other half to 2d. per gallon, those who followed this procedure would gain little, while those who dogged their footsteps would gain all. Only the strongest of trade combinations could render such an operation worth doing; and gas manufacturers in this country do not combine.

The industrial, as distinguished from the political, value of tar used as fuel seems to be worth a word or two of discussion at the present time, when there happens to be a strong interest enlisted in the cause of popularizing petroleum fuel. We have expressed the opinion that the fuel value of petroleum residues in this country is not much, if anything, more than ½d. per gallon, or 10s. per ton delivered. This judgment has to be proved wrong by an abundance of sales of the article for the purpose at a higher figure. No other evidence is worth consideration. Technical books and trade papers are full of records of the experimental balancing of fuel oil against solid fuels; but the market test is delayed. The burning of tar in gas-works to save coke or breeze is on all-fours with the similar use of fuel oil by oil steamers and locomotives having access to localized supplies. This is a little bit of domestic economy which is of no moment to outside traders. It scarcely seems that the present is a fitting time for forcing more coke and breeze upon the market by burning something else in their stead; but this, again, is a purely domestic question which may be answered differently in different establishments. There is not enough liquid fuel of any kind in the world to enable it to have a price of its own, irrespective of the equivalent in the solid form. The former class of fuel can therefore never be a staple. One can perceive this by asking what would happen if there were never a drop more of liquid fuel to burn. The value of coal would remain wholly unaffected.

There remains to be considered the third use of gas tar—for the making of roads; and one would like to know what is the absorption capacity of this market. Though there has always been a good deal of tar in demand for making pavements, still the whole volume of this business has been comparatively insignificant. During the last few years, however, the use of tar has extended to roadways, for the preparation of a description of macadam—"tar macadam," as it is called and appreciatively known in many localities. This application of tar has been carefully noted in these columns, for the sake of its promise in more than one aspect. It is admitted that the motor-driving and cycling public have a claim upon highway authorities for better road surfaces than are provided for dirty, iron-shod horses. The means of satisfying this reasonable demand exists in properly made and laid tar macadam. It is therefore to be expected that the fashion of this kind of road covering will spread, to the advantage of the highway authorities, the wayfaring public, and the producers of tar. A good tar-macadam road is smooth, elastic, durable, and clean. It costs more at first than ordinary macadam, for tar and labour; but the subsequent upkeep and cleaning costs 75 per cent. less. Thus the higher initial expense is more than off-set by the economy of working costs. Many road surveyors in different parts of the country have given attention to tar macadam; and one of its most enthusiastic partisans is Mr. George H. Owen, of Nottingham, who has read a valuable paper on the subject before the Midland Municipal Officers' Association. We regret that considerations of space prevent the reproducting of Mr. Owen's paper in its entirety, because it is full of practical "wrinkles." But we can give its substance.

Tar macadam is composed of stones cemented together with a mixture of tar and pitch, or of tar, pitch, and creosote oil. Both stones and the dressing fluid are heated—the former upon a

drying-floor of cast-iron plates carried over brick furnace flues, and the latter in cauldrons heated by the same fires. It is easy for an engineer to picture the arrangement, when he understands that the stone must be thoroughly warmed and dry, but not overheated so as to burn the tar. The stone is laid on the drying-floor in a layer which may be from 6 to 12 inches thick, according to its wetness. At Nottingham, slag is the only material used, broken to 2¼ inches for the bottom, and ¾ inch for the top. Experience is needed for the proper treatment of the tar. Mr. Owen prefers the raw tar from the gas-works, which has not been distilled, and boils it slowly from 1½ to 2 hours to the right consistency. The workman tells this by getting a little between his finger and thumb. If it rubs off too easily, it wants more boiling. Mr. Owen declares that pitch need not be added to the tar unless the macadam is to be used at once—which is so much the better, with pitch at its present value. He declares that from his own observations tar boiled properly has much more life in it, and will not perish so quickly as when pitch and creosote oil are added to it. Thin tar will require more boiling than a thicker sample; and this may be tested by boiling a small can of it over a bunsen burner, mixing it at intervals with some chippings.

In mixing, the best way is to have a large bucket, to hold 10 or 12 gallons of the hot tar. A "bottom" of 6 inches of the stone is laid on the smooth floor alongside the drying floor, or kiln, and as a couple of men shovel on to this the hot stone from the kiln, another keeps pouring the tar over it by means of a ladle, until the bucket is empty. Then the whole mass is turned over from the bottom. Such a gang can mix 10 tons per day of ten hours. The consumption of tar is after the rate of about 8 or 9 gallons per ton of stone; but this quantity will vary according to the quality of the tar and the nature of the stone. The more porous the stone, the more tar it will take. An addition of stone dust and chippings, enough to fill the voids, will improve the binding and absorb more tar. The treated stone should lie in a heap for three weeks or a month. When laid, which should be upon a good, hard, rubble foundation, a first layer, 4 inches thick, of the 2¼ inch material is put down and rolled. This is finished off with an inch of the ¾ inch stuff, rolled, and finally dressed with chippings or fine gravel. The rolling can be done during the cooler hours of the day, when the tar will not stick to the roller.

When a road surface is properly made in this way, it will be found that the tar macadam will not begin to show wear for some considerable time. It is so elastic that about a couple of years are required to enable it to settle down upon its foundation. When it does begin to wear, in ruts or pits, the hollow places should be carefully "picked" out, cleaned, painted with a little hot tar, and the surfacing made good with new stuff. When a road is very much worn, it is better to pick it up all over to a depth of 3 inches, remove the old stuff—which will again come in for use elsewhere after screening and re-tarring—and re-surface it with new material. The cost of tar macadam in Nottingham is given as about 20d. per square yard, materials and labour only. These, it has already been stated, are slag roads.

It would appear to be worth while for gas managers suffering from a surplusage of tar to keep an eye upon this system of paving, or rather of road making, and encourage their friends the district surveyors to improve the highways in this manner. The subject is very much in evidence at the present time; and those localities which can add the attractions of smooth and clean roads to their other advantages are likely to gain considerably by attending to this point of good government.

THE COURSE OF TRADE IN JULY.

THE returns relating to our foreign trade for the month of July show that the stringency in the iron and steel markets in the United States continues to have an appreciable effect upon the trade of this country—an effect that would be much more pronounced were it not that the home markets are very quiet and that business is in so depressed a condition on the Continent that British manufacturers have, in regard to American orders, to contend, not always successfully, against cutting competition from their rivals in Belgium and Germany. In spite of this fact, however, the exports of iron and steel from this country last month show a large increase over the corresponding figures for 1900 and 1901, and fall but little short of the high level of 1899. The totals for the month of July compare as follows: 1899, 370,014 tons; 1900, 267,143 tons; 1901, 259,066 tons; 1902, 343,551 tons. The imports for the same months, it should be said, show a steady increase (from 50,000 tons in 1899 to 96,000 tons in 1902); so that the actual net exports in July this year were less by 72,000 tons than they were three years ago. When it is mentioned that the exports of pig iron to the United States last month ran up to 59,442 tons—from 3293 tons in July, 1901, and 4029 tons in July, 1900—while the shipments to Germany have declined from 39,564 tons in 1900, and 18,265 tons in 1901 to 10,423 tons last month (bringing the total falling off during the year compared with 1900 up to 210,000 tons), the shifting character of our foreign trade in iron, and the care and inquiry necessary to arrive at any approximate idea of its future course, will be easily appreciated.

The dominant factor in the present situation is the condition of the market in the United States; and that is likely to be a prime factor in the situation very often in future. The consumption of iron and steel in the States is now so vast, and the productive capacity is accordingly being increased to such an extent, that when the consumption contracts and the possible output far exceeds the demand (a condition of affairs that is bound to come in time), the effect upon the British and Continental markets will be as unpleasing to the manufacturers on this side of the water as the present state of things is satisfactory to them—and more so. It is difficult to form any useful estimate as to when the back-swing will come in the States; but there is a general consensus of opinion in America that the native supply of iron will be below the demand there for some months yet to come. The output of pig iron during the six months ended June 30 was no less than 8·8 million tons (compared with a total of 9·65 millions for the year 1897); yet stocks were reduced and imports increased, while exports fell off. The "Iron Age" expresses the opinion that the trade outlook is good for another year, and remarks that the railways, by freely embarking in schemes for improving the facilities they can offer customers, are giving practical evidence of a similar belief. Even, however, if the present rate of export from this country to the States be maintained for the next twelve months, or increased to (say) 1,000,000 tons per annum, the productive capacity of our furnaces at present lying idle is quite capable of taking up the demand, while the competition of Germany (whose exports have gone up in the first half of this year from 942,000 to 1,444,000 tons), Belgium, and Canada would keep prices within reason. The effect upon the coal market would certainly be in the direction of stimulating prices somewhat; but a corresponding increase in the value of coke would accompany or precede such a movement. The course of affairs in the States will require some watching; but there is at present no cause whatever for any disquietude.

Meanwhile, the exports of coal continue at a high level. For the month of July, the sales to foreign buyers amounted to 4,132,743 tons, against 4,107,422 tons and 3,981,021 tons in the same month of 1901 and 1900 respectively. Shipments of bunkers were also higher; being 1,349,670 tons, compared with 1,311,438 tons and 979,097 tons. For the first seven months of this year, the total shipments of fuel read: 1902, 33,532,173 tons; 1901, 32,813,756 tons; 1900, 32,805,809 tons—so that this year the exports constitute a fresh record, exceeding that of last year by 718,417 tons. Coke exports still keep low; being 57,201 tons for July and 343,130 tons for the seven months, compared with 65,154 tons and 433,174 tons in the corresponding periods of last year. Freights remain at a very low level; and, in view of the excess tonnage available, they are not likely to rise materially for some time to come.

THE GAS AND WATER STOCK MARKET.

BUSINESS on the Stock Exchange last week was quite in its holiday proportions, as might be expected in the middle of August. But for all that there was scope for some variety of condition and tendency. At the opening, dulness was supreme, and the wretched weather helped to depress markets, especially the railways expectant of good holiday traffic returns. Then things took a turn for the better, and at one time there was even some sign of a recrudescence of that speculation which has recently been so disastrous. This was followed by another dull fit, which again brightened up somewhat before the close. So, on the balance, there is not much variation either way in ruling prices. The condition of the Money Market has been steady, and inclined to be quiet. Business in the Gas Market showed an improvement last week upon its predecessor in point of activity, and some issues which had long stood quiescent revived into animation. The general tendency, too, was quite favourable; all changes in point of quotation being uniformly in the upward direction, although they were neither numerous nor considerable in degree. In Gaslight and Coke issues, there was a fair amount of business done in the ordinary, which opened on Monday at 90, and on Wednesday touched 91¼, with an advance of a point in the quotation. But later in the week, it did not stand quite so strongly, and the closing mark on Saturday was no better than the opening figures of 90. Some moderate business was done in the secured issues, which were firm, but not inclined to advance. South Metropolitan was not particularly active. It opened at 125¼, and then dropped to 124; but, rapidly recovering, it closed at 125½. Commercials were very quiet; a single transaction in the old and in the new being all the business marked. But the old changed hands at 270, and the quotation rose a couple of points. There was hardly anything done in the Suburban and Provincial undertakings, and quotations were left unchanged. In the Continental Companies, there was renewed dealing in Imperial, which, at first, gave some prospect of making an advance. But this received a check; and the final mark was the easiest of the week. None of the more remote undertakings offered anything to call for notice. The Water Companies relapsed into the state of stagnation, from which they emerged last week to a slight extent, and there was no change of any sort in quotations.

The daily operations do not call for any further or more detailed review.

DR. TICHBORNE ON THE TESTING OF GAS FOR CARBONIC OXIDE.

When commenting recently on the report of the Chemist to the London County Council on the quantities of carbonic oxide present in London gas (*ante*, p. 261), we did not take exception to the trustworthiness of the returns showing the proportions of this constituent of the Metropolitan Gas Supply from day to day. Later, however, with reference to the Gas Regulation Bill, it was remarked that it will be somebody's business to inquire what the so-called regulation of a town's gas supply for carbonic oxide means. In the first place, obviously, it means the introduction of another system of gas testing; and in regard to the testing of illuminating gas for carbonic oxide, the process involved is of a very different order of chemical practice from anything hitherto expected of gas examiners. By a coincidence, Dr. C. R. C. Tichborne, recognized throughout the United Kingdom as a most competent authority on all questions of gas-testing, was happily inspired to take this subject for his lecture to the Irish Association of Gas Managers; and we publish elsewhere his highly valuable and very welcome contribution to the scanty stock of information available in this regard. It is not the purpose of this notice to criticize Dr. Tichborne's matter, but to emphasize the importance of everything that he, as an analyst, has to remark upon the general subject.

It is unnecessary here to repeat what Dr. Tichborne has to say about the advantages and drawbacks of auxiliary carburetted water-gas production as an element of gas-works administration of the present day. He has some fresh and very interesting observations to offer on this aspect of the subject, to which we only desire to direct the particular attention of our readers; because, as a matter of fact, they are quite original. Being before all things an analyst, however, it is not long before Dr. Tichborne brings up in front of the question of how the quantity of carbonic oxide in a sample of illuminating gas can be most accurately and conveniently ascertained. This is a point upon which the familiar technical text-books and manuals will be looked up in vain. Butterfield and Hornby both mention it; but in each case it is only touched upon as a matter of ordinary inquiry. It is nowhere exhaustively treated in the light of possible penal legislation. This is, of course, the present question. The gas manager now wants to know, not how the carbonic oxide of his gas may be determined just for the same kind of reasons as might make him curious in regard to its oxygen, but how to do it to the satisfaction of a Magistrate.

Dr. Tichborne, to do him justice, goes straight to the heart of the mystery, and describes how he analyzes illuminating gas for carbonic oxide. The gas industry is indebted to him for making this advance towards the standardization of a test which is not yet to be bought ready prepared of the usual purveyors of gas-testing appliances. As he remarks, his process is "not given in any of the books." Mr. C. B. Tully, of Sligo, has added his testimony to the convenience of Dr. Tichborne's method; but in regard to the general character of gas analysis for carbonic oxide, he offered the dubious recommendation that "there is no end to the subject." That is as may be; but there must be finality where a test is legalized, and one would like to have some assurance that the doctors are not likely to disagree, as the proverbial expression runs, over a question which the Justices may be required to decide. The most careful treatment of the subject of gas testing for carbonic oxide in any published work is to be found in Hempel's "Methods of Gas Analysis," translated by Dennis; and this is ten years old.

SUPPLEMENTARY ANSWERS TO THE QUESTION OF BOILERS.

By a fortunate coincidence, we are able to supplement our recent articles on "The Question of Boilers and Steam Fuel"* with the valuable conclusions of the Admiralty Boiler Committee, whose final report has just been published. In view of the controversy that has raged over the all-important questions referred to this Committee in September, 1900, and the thorough way in which the inquiry has been carried out by the experts comprising this body, it is very desirable that their last words for the present on the comparative merits of the cylindrical and the water-tube boiler should be in the possession of our readers. We say "for the present" in this connection advisedly; for the main question of what is the best boiler must always be relative to the date, and the Committee's report, while intended to be as nearly final as the circumstances of the case allow, explicitly states that no standard boiler can as yet be authoritatively recommended for the use of the Navy—or, inferentially, for other uses. Therefore, Admiral Sir Compton Domvile, the President of the Boiler Committee, in his covering letter to the Secretary of the Admiralty, suggests that "the Secretary and a nucleus" should be retained to watch developments, and to continue the investigations if necessary, under the supervision as Vice-President of Mr. J. A. Smith, Inspector of Machinery, R.N.

Let us admit at the outset that the composition of the Committee left nothing to be desired; but it is unnecessary to recite their names, especially as the report is unanimous. It will be remembered that they made an interim report in February, 1901, as well as other reports on points of detail, in which an opinion was expressed generally favourable to the water-tube type of boiler, in preference to the cylindrical type. Subject to the condition that a satisfactory kind of water-tube boiler was selected, they found that it would be more suitable for Navy use than a cylindrical kind. They did not consider, however, that the Belleville boiler possesses such advantages over other descriptions of water-tube boilers as to place it in the first rank of suitability. Nothing has since transpired to alter this opinion. The present report proceeds to summarize the disadvantages of the Belleville boiler as compared with the cylindrical boiler; but inasmuch as this is not an industrial aspect of the competition between the two types of steam generators, it is not necessary to go into it. Coming to what may be regarded as the general question, the Committee formulate the following list of the advantages possessed by a satisfactory water-tube boiler as compared with the cylindrical boiler: Less delay in steam raising; greater ease of repair and renewal of parts; reduction of weight for the power generated; ability to carry a higher steam pressure; and greater fire-grate area for the same floor area. We venture to refer with satisfaction to the very complete anticipation of these points in our previons articles, which were, of course, written without knowledge of the mind of the Committee. The grounds of comparison we laid down are therefore to be esteemed as adequate and trustworthy, in the judgment of the best authorities on the subject.

The report deals incidentally with various points of steam-engine design and the disposition of auxiliaries; but with these matters we have no direct concern. Those who are interested in the subject will find here some suggestive hints and criticisms. Speaking generally, it is the opinion of the Committee that, with the piston speeds now adopted, steam jacketing is of doubtful advantage. It is further advised that all pumps should be driven independently. Steam-pipes over 4 inches bore should be made of lap-welded wrought iron, with large bends to take up the expansion, in preference to packed expansion joints.

Having practically shelved the Belleville boiler, the Committee directed their examination to four different well-reputed patterns of large, straight tube boilers—namely, the Babcock and Wilcox, the Niclausse, the Dürr, and the Yarrow large tube. They regard all these as promising, and as having few of the disadvantages of the Belleville with most of its advantages. They speak very highly of the Babcock and Wilcox boilers as fitted in numerous merchant steamers, on account of their standing the test of ordinary usage without needing more than ordinary upkeep repairs. "Extremely well," is the judgment of the Committee on this important record of the performance of the Babcock and Wilcox boiler. There is less experience to go upon in respect of the other approved makes of water-tube boilers named; but trials of all are proceeding, the results of which are expected to go far towards solving the vexed question of which is actually the best type of boiler available.

There are, of course, numerous other descriptions of water-tube boilers in use; and the Committee in the course of their investigations had under consideration thirty-six different makes, large and small. None of these shook their preference for those already named; but several were found suitable for small units, while the development of others is declared to be worth careful watching. These are the Weir, the Stirling, the Thornycroft-Marshall, and the Thorneycroft-Schulz. During the trials of the cylindrical-boilered "Minerva," the Committee recommended that retarders should be fitted in the boiler tubes, which was done with much benefit; and it is therefore stated that, in their opinion, "retarders will be found in many cases to render existing cylindrical boilers more efficient and economical than they are at present." From the evidence before the Committee, it appears that no type of water-tube boiler at present in use is so economical of fuel as the cylindrical boiler. This important conclusion justifies what we have already advanced on the point. It has led the Committee to make a particular suggestion which has been much canvassed by amateur critics of the general subject. They observed, also, that a large proportion of the coal consumption of a King's ship is expended for auxiliary purposes in harbour.

Taking this circumstance into consideration, and having regard to the superior economy of the cylindrical boiler when worked at a regular gait, the Committee recommend that in large ships there should be provided a combination of cylindrical boilers of sufficient power to work the auxiliary machinery and to drive the ship at her ordinary cruising speed, while water-tube boilers should be held in reserve to supply full power at a pinch. Although industrial conditions of steam raising and power generation on shore are, of course, not the same as this, the nature of the Committee's advice very plainly shows what they think of the merits of the two types of boiler, and is therefore worthy of being placed upon record. To put the point slightly differently, it means that a reserve boiler anywhere might conveniently be of the water-tube type—at least, until such time as the fuel consumption of the type shall be reduced to that of its rival. It is a

* See *ante*, pp. 19 and 84.

necessity of the water-tube boiler that it should be kept clean and perfectly efficient, as would be conveniently done in this case. The Committee reiterate their counsel that cylindrical boilers should be fitted with retarders in the tubes and with special means for circulating the water while raising steam. It is to be noticed that they see no difficulty in working cylindrical boilers at the same pressure as the water-tube boiler—210 lbs. per square inch, so as to give 200 lbs. at the engines. Perhaps the remark as to assisting the circulation of the water has a bearing upon this point.

Lastly, the Committee state, without comment, that, from the information brought to their notice, water-tube boilers are being very little used in the British mercantile marine, and that their use in such ships is increasing very slowly. The Babcock and Wilcox is the only boiler of the type in such service. Other countries are experimenting with the type; but there is no consensus of opinion as to which is the best. In this connection, it may not be inappropriate to mention that the new marine type of Babcock and Wilcox boiler has been adopted for the extension of the Shoreditch borough electricity supply works, if only to illustrate he close relationship of steam-raising problems on sea and land. Technical points of detail in connection with engine and boiler design are dealt with at considerable length by Mr. John List, the Superintending Engineer of the Castle Line. His remarks are rather in amplification and elucidation of the very terse passages of the report than in objection to its tenour. It was evidently the desire of this conscientious member of the Committee that the report should not miss its mark for want of clear directions; and though Mr. List's observations are more highly specialized than the matter one expects to find in these official documents, there is no gainsaying their point and sincerity.

The one thing that strikes us, after what was remarked upon this head in our articles, as being a glaring omission from this report, is all reference to the furnacing. Nobody would gather from the text, or even from Mr. List's laborious commentary, that it matters one jot how the fire is burnt for making steam in any kind of boiler. True, the Committee include "greater fire-grate area for the same floor area" among the typical advantages of the water-tube boiler; but they leave it at that. Their attention seems to have been occupied by water line, and tubes, and other details of the boilers; and all these steam generators might be fired with one and the same furnace, for all the notice they give to this part of the equipment. This may be a justifiable exercise of the art of exclusion of the non-essential, which is so important a part of the judicial form; or it may be a sheer omission. The difficulty is that there is nothing to show one way or the other. Are the fuel-burning principles of Frederick Siemens recognized in the furnacing of boilers; or are they ignored? The report does not help us to answer the question. There is the usual mention of good and bad stoking, and their consequences; but not a word respecting the proportioning of the fire-grate areas to the work to be done, or anything to indicate that the boiler-maker holds himself responsible for the provision of a suitable furnace. Bad stoking is not all the stokers' fault; but they usually are made to bear the blame for everything of the kind, from burnt plates to smoky chimneys.

On the whole, we are persuaded that everybody who is interested in the subject of boilers and steam-raising ought to procure a copy of this report, which only costs a few pence; while engineering students will find it an invaluable guide to all that is best worth knowing about the most modern boiler practice. This is really one of the most useful purposes to which these official publications can be put; and it is something to be thankful for that examiners do not make use of them for the preparation of "papers." As it is, they are information of the highest class; and as such they are worth to the industries of the country far more than they cost the taxpayers. A bulky volume would be required to describe all the appliances and machinery brought within the scope of this report; and the members of the Committee are to be complimented upon having seen their way to a comprehensive and fairly conclusive common judgment upon the vast mass of evidence laid before them. Few more important investigations have been held, within the period of the industrial history of the country.

ELECTRIC LIGHTING MEMORANDA.

Result of a Free-Wiring Agreement—The Rewards of Technical Education—Bad Condition of the German Electrical Trades—South Shields and Depreciation.

A CURIOUS hitch in the way of so-called "free-wiring" arrangements came before the public eye recently at Greenwich, where a shopkeeper was summoned in the County Court by the National Electric Wiring Company, Limited, for 25 guineas damages for wrongful conversion of an electric light installation fitted by the plaintiffs in the premises now occupied by him. It appeared that the plaintiffs had entered into an arrangement with the previous tenant to put in the installation, on the terms that they were to receive as their remuneration a rent of so much per unit of current used, with a minimum charge per lamp. This tenant went away owing rent and leaving all the fixtures standing. The landlord, knowing nothing of the "free-wiring" arrangement, allowed the incoming tenant to take the fittings in part consideration for his putting in a new shop front. The plaintiff Company informed the new tenant of the state of affairs; but he claimed the fittings as his own property—giving, however, to the plaintiffs the option of removing them, as he had an estimate from somebody else to put in a fresh installation for £6 cash. The plaintiffs elected to take other proceedings, with the result that they lost their case; the Judge finding for the defendant. There is a whole bagful of morals about this story, which readers can pick out for themselves.

An instructive contribution to the controversy on technical education, and its rewards and encouragements, is made by a correspondent of the "Electrical Review," who avers that some 2000 successful students leave the colleges and technical schools of the United States every year, "qualified in every detail from the expert handling of the stoker's shovel to the commercial managing of station accounts;" and all wanting employment. At this rate, the avenues to fame and fortune in the profession of electrical engineering would seem to be already hopelessly choked. What is the use of urging young men to get themselves technically educated, at great expense to their parents, if they are to be turned into the world a few years later to fight for berths at £150 a year? If this goes on to much greater lengths, "the expert handling of the stoker's shovel" will prove the most valuable of all the accomplishments of college-trained youth; so that those who have the strength to practise what they know of this indispensable art will be able to laugh at the others who are too intellectual to handle anything heavier than a pen or a drawing pencil. This is what over-education will bring its victims to at last; and the work-a-day world will pay more in that day for brawn and power to endure hardship, than for all the lore in the higher mathematics resident in a fragile being who cannot feed a furnace fire.

An impressive tale of the disastrous results of the over-reaching ambition of German electrical engineering during the past few years is told in the "Electrical Review," with the object of discounting the exaggerated praise of German enterprise which has become such a commonplace of professorial oratory. It appears, among other things, that Protectionist Germany wants to be more Protectionist still, in the expectation of becoming self-supplying with electrical plant and other necessaries. If this desire is gratified as the result of the operation of a new tariff, a very small portion of the existing works will be sufficient to meet the home demand; and what will the remainder do then? In the circumstances, it is not surprising that Berlin and Hamburg and some other large centres of population are contemplating large electric railway schemes. This will find work for a period; but too much of this kind of thing will come perilously near the fabled way of living "by taking in one another's washing." The great Schuckert Company are passing their dividend for the year just concluded, having dropped £770,000 somehow during this period. The Lahmeyer Company, of Frankfort, have lost £124,693 during the past year—a good deal of it in Russia. Several prominent German electrical engineering firms have gone into liquidation outright, and others only exist to pay interest on bankers' advances.

The electric lighting of South Shields is an example of municipal trading which has greatly exercised some of our contemporaries. One of these, which claims to specially represent the cause of sane and prudent local government, took the case of this municipal undertaking as the text for an article remonstrating on the manner in which some local authorities have plunged into unnecessary liabilities of quite uncertain extent. In order to hoodwink the ratepayers as to the unfortunate results, the accounts of the undertaking are alleged to be unsatisfactory and misleading, important facts concerning expenditure incurred (and paid for out of the rates) being suppressed. The supply was started in 1896. By 1899, deficiencies to the amount of £5114 had been made good out of the rates. Up to March, 1901, after deducting alleged surplus profits, there was still a net balance of £3224 against the ratepayers. The accounts of another year's working have now been issued. No provision has ever been made for depreciation, renewal, and antiquation of plant; and the allegation is that if only 3 per cent. is charged to cover depreciated value and renewals—to say nothing about loss of value through the plant becoming old fashioned—the ratepayers stand at a loss on the venture of £16,010, which must be paid somehow and at some time. Naturally, this unkind criticism gave very great annoyance to the authority implicated, and the responsible officials had no difficulty in rebutting the charge of concealing the amount of the ratepayers' subvention to the finances of the undertaking. Indeed, it was observed with self-evident truth that the facts of these annual deficits and calls upon the rate fund are "only too obvious to those interested in the undertaking." An electrical contemporary, however, has in this case taken the side of the critics of the borough system of financing the electricity supply, and declares that "the admitted deficiency in the trading is of far less importance than the omission of all provision for depreciation, antiquation, and renewal of plant, for which the sinking fund cannot be legally applied, being ear-marked for payment only of the original cost of the buildings and plant." Upon the 3 per cent. basis, the amount of the deficiency on this account in the case of South Shields is stated to be £13,569. This may be, and very probably is, correct; but why confine the accusation of improvidence to South Shields? Where is the electricity supply undertaking which is in reality

"as good as new," by reason of having been kept in a thorough state of renewal and repair out of revenue, with money put by to answer for the antiquation of the plant as a whole and in detail? South Shields is no worse than most others in the same line of business; and there is no apparent reason whatever for singling it out for special condemnation on this score.

PERSONAL.

Mr. ALBERT LATHAM, M.Inst.C.E., who has been Borough Engineer and Surveyor of Margate for 29 years, has resigned this position, on being appointed Engineer of the new water scheme.

Mr. HORACE BALDRY, District Inspector at the Norwich station of the British Gaslight Company, has been selected to fill the position of Outdoor Superintendent to the Crystal Palace District Gas Company, in succession to Mr. Auchterlonie, who has been appointed Manager of the Cambridge Gas Company. The vacancy was advertised in the "JOURNAL" for the 29th ult.

There were 32 applicants for the position of Manager of the gas, water, and electricity works of the Kendal Corporation, rendered vacant by the appointment of Mr. T. N. Ritson as Mr. Valon's successor at Ramsgate. These were first of all reduced to six, who had an interview with the Committee, with the result that Mr. W. THOMPSON, of Paisley, has been recommended to the Council for approval. Great satisfaction is expressed in Kendal at Mr. Ritson's success, though many of his friends will feel his removal to the South as a personal loss.

OBITUARY.

Sir THOMAS JAMIESON BOYD died at his residence in Moray Place, Edinburgh, on Friday last, in his 85th year. Sir Thomas was a notable man. His greatest work consists in the scheme he promoted, by which the schools under the charge of the Edinburgh Merchant Company were converted from big monastic institutions, where one or two hundred boys were educated, into open schools for both boys and girls, at which some four or five thousand children receive the highest possible education, short of University training. He was also the prime mover in the erection of the new Royal Infirmary of Edinburgh. He was Lord Provost of Edinburgh for two terms, and received knighthood from the late Queen Victoria when she visited the city on the occasion of the Volunteer Review in 1881. In business he was a partner in the firm of Messrs. Oliver and Boyd, publishers, the proprietors of the well-known Scotch almanac, which is regarded as almost an official publication. For many years he was Chairman of the Edinburgh Gaslight Company, till the date of the transfer of the undertaking to the Corporations of Edinburgh and Leith in 1888.

An Italian Gas Review.—We have received the first number of a new Italian monthly publication devoted to the gas interests. It bears the title of "Il Gaz," and its Editor is Captain Vittorio Calzavara. The contents consist of articles on technical and industrial matters, abstracts of patent specifications, notices of books, biographical notices, legal and commercial intelligence, and a list of new patents; and they occupy 64 large quarto pages. In his opening address, the Editor sets forth his programme, in the carrying out of which he will have the support and collaboration of Professor Lewes, Dr. Strache, and several scientific men occupying prominent positions in Italy. The new publication is well got up, and we cordially wish it a useful and successful career. The headquarters are in Venice.

Mid-Rhenish Association of Gas and Water Engineers.—The 39th annual meeting of this Association will be held on Sunday and Monday next (Aug. 31 and Sept. 1) at Freiburg-im-Breisgau, in the Grand Duchy of Baden. In addition to the transaction of private business, the proceedings for the two days include the reading and discussion of the following communications: "A Description of the Municipal Gas and Water Works of Freiburg," by Herr Schnell, the Manager; "A New Lighting Device for Gas-Burners and a Water-Heater," by Herr Himmel, of Tubingen; "Experiments on the Supply of Water Gas to Coal Gas Retorts while Carbonizing," by Herr Croissant, of Ludwigshafen-on-Rhine; "A Naphthalene and Cyanogen Washing Plant," by Herr Ritzinger, of Kaiserslautern; "Advances and Experimental Results in Cooking by Gas," by Herr Schöne, of Dessau; "The Importance of the Meter for Measuring the Volume of Water Distributed," by Herr P. Wagner, of Strassburg; Report on Gas-Fitters' Schools, by Herr Reichard, of Carlsruhe; "Gas Novelties," by Herr Blum, of Berlin; "The Osmium Lamp," by Herr Nathan, of Berlin; "Coke-Conveying Plant," by Herr Coburger, of Mülhausen; "Economical Purification," by Herr Lempelius, of Worms; and "Rapid-Acting Pumps," by Herr C. Reuther, of Mannheim. A good programme of festivities and excursions has been arranged in connection with the meeting; and the gas and electricity works of Freiburg will both be visited on the Monday. At the gas-works, charging machinery of two different makes (the Berlin-Anhalt Engineering Company's and C. Eitle's) will be shown in operation.

NOTES.

New Tool-Steel to Work Hot.

The remarkable results obtained by Messrs. Taylor and White with the American tool-steel which, as shown at the Paris Exhibition, ran at a red heat in fast-cutting machine tools, have revolutionized the practice of many steel makers in England and on the Continent. Many different varieties of high-speed tool-steel are now upon the market; and machine tools are everywhere being run at speeds which a few years ago would have been regarded as chimerical. This advance is largely due to the demands of works managers, who have in many cases refused to submit to the prescriptions of old-fashioned makers of tools, insisting on specifying their own requirements in this line. It is reported in "Engineering" that Messrs. Jones and Colver, of Sheffield, are among the steel makers who have set themselves to beat the American novelty in hot-running tool-steel. They have produced a brand of steel which they call the "Air Novo" steel, which can be safely forged at a much higher temperature than ordinary steels, and is easily worked and tempered. It is hardened by being heated to a full lemon colour, and then cooled by an air-blast or in very hot water. As to the working results, the makers state that a hard cast-steel pump plunger, 10 inches in diameter, was cut $\frac{5}{8}$ inch deep, at the rate of 80 feet per minute, for 40 minutes. At the end, the tool was found perfect. Other materials can be cut at comparable speeds, though the trimmings may come off purple, and the edge of the tool be red-hot.

Cheap Steam Heating.

Some details as to the performance of a steam-heating plant in the vicinity of Boston, Mass., have been published in the "Engineering Record" by Mr. A. R. Abbott, the Engineer. These probably represent an achievement of high merit for the system of heating employed, in regard to which ample experience must have been accumulated. The standard worked to was the usual American one of 70° Fahr. internal temperature with zero weather outside. The heating season commenced in October, with 158 hours' steaming, increased to 308 hours in November, and rising to a maximum of 423 hours in January. For April, the hours of steam heat fell to 197, and in May to 63 hours. The outside temperature during the three winter months was scarcely below freezing point; so that the "zero weather" was a fiction. Altogether, the steam was on the radiators for 2095 hours, and the inside temperature was not allowed to fall below 70°, as designed. The building was of four floors, and in every room the steam radiators were based upon a standing proportion of one square foot of radiating surface to 80 cubic feet of content. This was, however, modified in some of the rooms according to exposure, or the amount of glass; the ratios varying from 1 : 65 to 1 : 105. The fuel consumption for the whole season was after the rate of 40 lbs. of coal per square foot of radiating surface. Counting in corridors and staircases, the average ratio of radiating surface to cubic contents is 1 : 112. There was 2,520,000 cubic feet of space heated at a cost of $1680 for coal, which brings the cost of heating 1000 cubic feet of space for the whole season to no more than 65 cents—a remarkably low figure.

Wet v. Stiff Mortar for Brickwork.

Discussing the subject of brickwork and mortars in the "Student's Column" of the "Builder," the writer of the series of articles remarks on the change that has lately come over the practice of laying bricks. Whereas for many generations it has been accepted as axiomatic that good brickwork can only be built by using bricks saturated with water and the stiffest possible mortar that could be worked, nowadays the fashion has grown of using unwetted bricks and mortar mixed so wet as to be sloppy. The old idea in wetting the bricks was to prevent them from absorbing moisture from the mortar and thus hinder the latter from becoming properly set. The change to dry bricks and sloppy mortar has much to recommend it from the workmen's point of view. Dry bricks are lighter and less unpleasant to handle than wet ones; and sloppy mortar can be more rapidly spread than stiff mortar. A trowel charge of sloppy mortar can moreover be made to cover twice as many bricks as a charge of stiff mortar, and less energy is expended in tapping the bricks into place. Besides, bricks are often delivered upon a job and hoisted right away to the scaffold, where there are no means of wetting them. Theoretically, the use of sloppy mortar and dry bricks is wrong; for although the excess of moisture in the mortar tends to remove the objection to the dryness of the bricks, yet there must be a tendency for the components of the mortar to separate owing to their different specific gravities and physical character. It is admitted, however, that buildings which have been erected with sloppy mortar have not collapsed; and in the absence of comparative tests of the opposing systems by competent authority, it is not surprising that the obvious merits of sloppy mortar in actual construction are rapidly increasing its popularity.

Cost of Power from Producer Gas.

The application of producer gas engines for generating electricity on a considerable scale is more general on the Continent than it is in England, for a variety of reasons. The Barcelona tramways are worked in this way, the cost of power per kilowatt-

hour being only 1d., though the anthracite coal used cost 37s. 6d. per ton. M. Thonet, of Liège, who reports on this plant, confirms the conclusions of M. Witz as to gas-producer efficiency being slightly better than steam-boiler efficiency, while the gas-engine is far superior to the steam-engine. The net result of the combination is therefore that the consumption of fuel in the smallest gas-power units is less than that of the largest steam-power plants, even when using superheat. This is the central fact of the position, as regards power generation. With regard to capital cost, a producer-gas plant will not exceed about £30 per available kilowatt, and may be considerably less. On a small tramway of 14½ miles known to the author, it cost under £25 per available kilowatt to provide producers, purifiers, holders, dynamos and water-mains. The estimate for steam plant came to less than £18 per available kilowatt; whence it would appear that the advantage of gas power must be sought in economy of working. This is usually borne out by experience, even with dear anthracite as producer fuel. Of course, a cheaper, dirtier fuel can be procured in some places for this purpose; but this entails the use of a complete gas purifying plant. Consequently, where the fuel has to be transported any considerable distance, the best anthracite proves the cheapest.

Moore's Vacuum-Tube Lighting.

It is now some years since the method of lighting interiors by means of vacuum tubes was claimed by Mr. D. MacFarlan Moore; and yet there is no sign of the system coming into practical use. It is therefore almost as a surprise that one learns of the issue of United States patents to Mr. Moore for his invention of "tube lighting." As described, this consists of distributing or running a translucent tube or receptacle over areas, spaces, or rooms to be lighted, the terminals of the tube being brought to a source of energy outside of the areas or spaces, or in a location where the terminals may be suitably protected against danger of contact or accidental interference. The tube is to contain a gas which is of such character or degree of rarefaction that, by the application of electric energy or current to the terminals of the tube, it will be rendered luminous by the transfer of the energy from one terminal or electrode to the other. In the practical installation of the system, the translucent tube of glass may be built up in the position it is to occupy while in use, or otherwise distributed as a tube of glass over the spaces to be illuminated. For illuminating the interior of a dwelling or structure, the portions of the glass tubing which contain the luminous column from which the effective illumination is obtained, would be distributed in any desired way throughout the whole interior of the dwelling or structure as one or more tubes, with the conducting caps or terminals brought outside to a place out of harm's way. The piece of illuminating element which Mr. Moore prefers consists essentially of a translucent tube whose conducting terminals or electrodes are metal caps or carbon paste attached closely to the exterior of the tube, and transferring their energy by electrostatic action to the contents of the tube itself.

Plates of steel (says a writer in the scientific notes column of "The Globe"), stamped with ornamental designs, are now used in America for plaster mouldings in ceilings and cornices. The plates are easily removed, and the space behind them serves for concealing gas-pipes and electric light or telephone wires.

The business friends of Mr. Fred. Hatcher, the proprietor of Messrs. S. Clark and Co., Syphon Works, Park Street, Islington, will join in congratulating him on his marriage to Miss Julia M. H. C. Claus, daughter of Mr. Charles Claus, of Brussels. The happy event took place on the 14th inst., at St. Mary's, Clapham.

The sums received by the local authorities in England and Wales during the year 1899-1900, according to the annual local taxation returns, amounted to £100,640,991, and their expenditure to £100,862,280. The sum of £40,734,219 was derived from public rates; £12,249,083 from grants and other receipts from Imperial taxation; £12,251,996 from revenue produced by water, gas, electricity, and tramway undertakings; while £23,438,816 was borrowed. Of the expenditure, £15,698,721 was devoted to the repayment of borrowed moneys and the payment of interest thereon. The outstanding loans of the local authorities amounted at the end of the year 1899-1900 to £293,864,224.

In an article dealing with the Düsseldorf Exhibition in the current number of "Engineering," it is stated that the coke production of the Dortmund district exceeded 8,300,000 tons in 1900, of which more than 3,000,000 tons were consumed or sold in the district itself. A pyramid of coke-oven products—a group exhibit of three collieries—consists of a cube of one cubic metre, representing a ton of coke, as base, and smaller cubes, representing the yield in tar, sulphate of ammonia, and hydrocarbons. The chief tar products are pitch, creosote oil, crude naphthalene, anthracene oil, and crude anthracene; the chief hydrocarbons are benzol, toluol, xylol, solvent naphtha, and naphthalene. Of the three collieries named, one employed in 1900 a staff of 2253 men, and produced 497,730 tons of coal, 101,823 tons of coke, 1873 tons of tar, 662 tons of sulphate, 175 tons of crude benzol; and another, with 2240 men, produced 562,270 tons of coal, 211,520 tons of coke, 3313 tons of tar, 1393 tons of sulphate, 646 tons of crude benzol, and 383 tons of other hydrocarbons.

TECHNICAL RECORD.

SOME POINTS ABOUT THE PROPERTIES AND TESTING OF CARBURETTED WATER GAS.

By Dr. C. R. Tichborne, Board of Trade Gas Examiner to the City of Dublin.

[A Lecture delivered before the Irish Association of Gas Managers.]

Although it always gives me great pleasure to address you, I must confess to a feeling of regret as to the cause which brings me here to-day. I am trying to fill a place which would, under any circumstances, be difficult to fill, but which, under the sad memory that it evokes, is to me absolutely depressing. Besides this, if Professor Macadam had not met with his sudden and untimely death, I am sure you would have been treated to a well-considered and well thought-out discourse. Under the circumstances of the short notice and pressure of business, I regret that I cannot do more than offer what may be considered as disconnected jottings on some points in connection with carburetted water gas, such as I think may interest most of my listeners.

The desirability of the use of carburetted water gas was very generally discussed when it was first introduced in Ireland and England, and ultimately ended in a report of the Departmental Committee upon its use. The sittings of this Committee presented the usual results as regards any debatable subject—the evidence was of the most contradictory character, and the report of the Committee itself of rather a neutral character. This report of the Committee may be crystallized into—

1.—A recommendation that only the production of carburetted water gas should be encouraged as against the use of water gas itself (which is odourless), or that it should always be mixed with some strong-smelling gas.
2.—That a limit should be placed upon the amount of monoxide of carbon present in the gas supplied to the consumer.
3.—That local authorities may have the power to inspect fittings of private houses in a similar manner to the control of the water supply.

To the first two, no one, in my opinion, should object; and as regards the last, if such supervision be insisted upon (as necessary), I can see no objection. But I cannot help feeling that if such inspection is absolutely necessary because of the introduction of carburetted water gas, it was necessary with ordinary gas, and always has been so. There is full justice done in the report to the undesirability of restricting the development of industries.

I think that it was in an old book written by Accum, a popular Chemist of the twenties, who describes the panic that was caused in London when it was first proposed to introduce gas into that City in 1807. According to the then popular idea, London was to be blown to pieces by a series of small local volcanoes, and probably end in a general conflagration. Imagine the Londoner of to-day having any fear of gas! He has got used to the idea of it; but what is still more important, he has been educated up to understanding it and all its dangers. By way of illustration, look at railways. Recollection carries me back to my boyhood, when small accidents on the railways happened every week. The deaths would be two or three persons killed and (say) fifteen sent to hospital. If you take up a "Times" of the fifties, you will find I do not exaggerate. Every year the passenger traffic has been increasing by leaps and bounds; but how often do you hear of an accident in England or Ireland? The safest place to get into in London or Dublin is a railway carriage, and a "penny weekly" will insure you against railway accident for next to nothing. Other instances will occur to you of new industries emerging out of opposition produced by fear.

Now, as regards the use of carburetted water gas, the dangers are not of sufficient importance to warrant any serious restrictions upon its use—providing proper precautions are employed, and the public get familiar with its properties. I have at the same time a very decided opinion that the percentage used should be controlled, and I am entirely in accord with the recommendation of the Committee. Let us see what are the disadvantages, and what advantages we have on the other side. Monoxide of carbon, *per se*, is undoubtedly a much more poisonous substance than ordinary coal gas; but the latter is itself sufficiently poisonous to do almost all the same amount of mischief if it is abused. This poisonous property, as far as I can see, is the sum total that can be urged against it. On the other hand, as a set-off against this, we have a formidable array of advantages:—

1.—The wonderful facility and rapidity with which a large supply can be at once made.
2.—The high and increased illuminating power easily obtainable.
3.—Less impurities which are deleterious to furniture and plants.

4.—Ultimate cheapness to the consumer. This is a question I do not intend entering into; but I take the economical view that if you can make gas cheaper, the consumer will ultimately get the benefit.

5.—I should say the constant trouble with naphthalene in mains will be largely modified, if not entirely disposed of.

The first of these—namely, the facility in making—would be superfluous for me to dwell upon with you. It is a question which gas managers could discuss by themselves to much greater advantage than by listening to anything I might say.

The second advantage—*i.e.*, the increase in the illuminating power—I have also little to remark upon. It must be highly appreciated by those gas engineers who are bound to a certain standard, and they must feel delighted that they are enabled to say good-bye to cannel coal. But I have made an observation which some of my audience may also be aware of, and others may not—that carburetted water gas is much more sensitive to a fall of temperature, and *pro ratâ* to a fall in illuminating power, than ordinary coal gas. This is, on some occasions, almost startling, and may cause trouble if not carefully borne in mind. With the use of cannel coal gas, this susceptibility to a change of temperature is not so self-evident. We must never forget that the gas-mains are not at the temperature of the earth because they happen to be some feet below the level of the street, but they are at the temperature of the street atmosphere, and fall and rise with it.

A main is a metal pipe through which the gas is comparatively slowly passing, and made of a good conducting material. It is connected with the atmosphere at comparatively short intervals by conducting rods in the shape of lamp-posts. A shower of rain immediately lowers the temperature of the mains beneath that of the earth in which they are placed. To my mind, I cannot help comparing it to the well-known Liebig condenser which the chemist uses in his laboratory to condense a vapour. The vapour is passed down a tube which is kept cool by a stream of water flowing on the outside of it. It is wonderful the amount of heat this two feet of tubing will absorb, and the amount of work it will do in condensing.

The third question is one of the decrease of impurities, especially sulphur. This decrease is of great importance, and has always been emphasized as one of the practical objections to the use of coal gas on the part of the consumer. Some doubt has been expressed as to there being any reduction in sulphur in the carburetted water gas. It is my experience that there is a very considerable improvement in this respect. Dr. Haldane, in his exhaustive report* on the "Mode of Occurrence of Poisoning by Lighting Gas," and which is the most important report we have received up to the present time upon the subject of carburetted water gas, does not deal very extensively with this part of his subject. He does not speak either very decidedly upon it, nor does he seem to have formed any definite opinion, based on his own investigations. At the same time, he seems to infer that there is not much difference between ordinary coal gas and carburetted water gas in this respect. In case I may misread his views, I give you what he says upon this point: "Carburetted water gas has been stated to contain, when purified, much less sulphur than coal gas. It may, however, be pointed out that the official analyses (quoted in Mr. Humphrey's evidence) of the sulphur in New York carburetted water gas contains strikingly less sulphur than well purified coal gas, The average is about 8 grains per 100 cubic feet. According to Mr. Lewis T. Wright, well purified coal gas should contain about 7 to 10 grains. The average of the series of analyses in an official report on the coal gas of 56 Massachusetts companies in 1884, before the introduction of water gas, was only 9 grains."

Of course, the amount of sulphur in ordinary coal gas will largely depend upon the question of whether ferric oxide or lime purifiers are employed. I think I am right in stating that in large cities the iron process of purification is mostly, if not wholly, used. In such cases, it will be found that it is with great difficulty that the sulphur can be kept below 18 to 20 grains. By the use of 30 to 40 per cent. of carburetted water gas, my experience is that such a gas falls at once to 10 or 11 grains, thus—

Grains of Sulphur per 100 *Cubic Feet.*

Gas Referees' Process.

Average of four experiments taken at different periods on ordinary coal gas, of 16·5-candle power.	19·40
Gas containing on an average 30 per cent. of carburetted water gas.	10·30

The point I wish to establish is that the carburetted water gas gives much lower results as regards sulphur products than coal gas, and probably reduces it *cæteris paribus* to nearly one-half. My experience is that when using coke this is so; but I should imagine if anthracite were used hardly any sulphuric acid would be found among the products of combustion. I have no experience of water gas made from anthracite. The coke used in one instance gave 1 per cent. of sulphur in excess over the sulphur contained in the ash. The 66 per cent. of coal gas which produced this coke gave, mixed with 33 per cent. of carburetted water gas made from the same coke, a gas showing 9·3 grains of sulphur per 100 feet.

We now come to the consideration of the second point—viz., the recommendation that there should be a limit for carbon monoxide. If it is decided that the amount of carbon monoxide (or carbonic oxide, as it used to be called) should be controlled just in the same manner as sulphur or ammonia are controlled—it becomes absolutely necessary that the gas manufacturer should be in a position to do this promptly and with a certain amount of comparative accuracy. To those who have been dealing with water gas, a great deal of what I am going to say may be considered stale and unprofitable. Therefore, to those engineers who have so far been hardly acquainted with such a gas, my remarks must be addressed.

It is strange to find that when one wants to put one's hand upon information of this kind how meagre the general chemical works are. The descriptions as given in dictionaries of technical chemistry would hardly do for the gas engineer; but some scattered information may be found through Butterfield's "Gas Manufacture," or Hornby's "Gas Engineers' Handbook." The method adopted for the determination of carbon monoxide will be generally found to be as I now describe it, although various manipulators may slightly diversify the *modus operandi*. All the methods, however, are based upon a curious property which carbon monoxide possesses, of being absorbed either by acid or by alkaline solutions of cuprous chloride (Cu_2Cl_2). The compounds formed are stated to have the following composition: $CO.Cu_2Cl_2.2H_2O$.

Cupric chloride ($CuCl_2$) is the stable compound of copper and chlorine which is found in commerce; and this substance is a very soluble, beautiful, green salt, which in solution becomes a beautiful blue or green-blue. This salt is the one most convenient to use, although not referred to in the above-mentioned books. Cuprous chloride (Cu_2Cl_2), however, is the salt which has such an affinity for the monoxide of carbon. It is a substance which is nearly insoluble in water, and when pure is practically white. Here in this tube I have sealed up a mixture of metallic copper and cupric chloride—a red powder and green crystals, giving a pale-blue solution. After sealing the tube in the blowpipe, it is heated, and, as you see, we obtain a whitish powder and a colourless supernatent fluid. The two substances have coalesced so as to form cuprous chloride, according to the equation: $Cu\,Cl_2 + Cu = Cu_2\,Cl_2$.

The ammoniacal solution of this salt is blue when it absorbs oxygen from the air, and becomes colourless when the oxygen is excluded. The hydrochloric acid solution is a yellow-brown solution, nearly black in the presence of oxygen, but also becoming colourless when the oxygen is excluded. This cuprous chloride is not a stable molecule, but always tends to absorb oxygen. I can illustrate this by a rather pretty experiment. I have here a sealed tube which contains some cupric-ammonium chloride. A piece of copper foil has been placed in it before sealing, and it has then been heated for some time in a water bath. You will observe it is colourless, because the copper has been converted into cuprous chloride; but on breaking the tube, it immediately becomes intensely blue from absorption of the oxygen of the air, which re-converts it into the cupric salt.

Now, I have already stated that this cuprous chloride in acid solutions has the power of absorbing carbon monoxide. What this compound is, is hardly known. It is so difficult to get it in a definite form, and it is so prone to decomposition, that we can hardly say any correct analysis has been made. It is generally accredited with the composition I have mentioned above.

The principle by which we determine the carbon monoxide would be extremely simple if it were not for some other gases with which it is associated in lighting gas, and which must be removed, or they would seriously affect the results. It simply consists in absorbing the different gases in a graduated glass tube fitted with glass stop-cocks at each end. There are various forms of tubes which might be used for this determination; but I think that the simplest is Bunte's gas tube, or, more properly, gas-burette, which has been modified and provided with certain improvements. It is a graduated tube, divided into cubic centimetres, and sub-divided in cubic millimetres. The upper part is bulged, and is larger than the lower part, merely that you may have a large proportion of gas to operate upon and yet retain your area of reading in the lower or narrow part of the tube. The bottom tap lets the liquids flow away; the upper tap is surmounted by a graduated funnel to introduce absorbing solutions. It should be a two-way cock for convenience.

As simplicity is the most desirable part of any practical process with this modified Bunte's tube, I add to it a fairly large cylindrical jar; and with these two I propose you should do your estimations. This cylinder is supplied with a flow of water in connection with a large reservoir of water, or a constant supply, such as we would get at most towns from the tap. The water supply should be carried to the bottom of the cylinder, the overflow passing away at the top. This is to ensure a uniform temperature during the experiment; and as the reading of the gas in the tube is merely the difference of the readings, this will be always practically correct owing to the uniform temperature maintained by the flow of the water in the cylinders. A large supply never varies even to the fraction of a degree during the time of an experiment. When we consider that the gas is, for every degree of temperature it may be raised, increased in volume 0·02 per cent., we can see the importance of this detail, although very little attention is paid to it in practice.

The two-way cock is opened to the air, and the gas is passed in through the bottom tap for a few seconds to sweep out the air. First the upper tap is closed, and then the lower. You will

* See "JOURNAL," Vol. LXXIII., p. 449.

observe that the Bunte tube is graduated some distance below the zero mark; and at this stage you must remember that the entire tube is filled with the gas. Therefore, to rectify this, a little U-tube, filled with water, is slipped over the outlet on the top tap. The bottom tap is then opened, and the burette is lowered into the cylinder of water until it is on a level with zero. On opening the top tap on the outlet the water will rise to zero. The funnel at the top being supplied with two stoppers, enables the operator to insert the absorbent by degrees, and shaking it if necessary, without splashing it about; or, as an alternative, by regulating the flow of an absorbent at the top and opening the bottom tap under the water level, a little practice will enable you to pass the water through the tube without losing a particle of gas. This is illustrated by the aid of coloured fluids. It is necessary in washing out the Bunte tube to pass at least 100 c.c. of water through it. For the reading or estimation of the carbonic acid gas, a solution of caustic potash, made by dissolving three parts of ordinary caustic potash in two of water, is introduced into the Bunte tube or burette, and after bringing to the normal temperature, a reading is taken, which represents the absorption of the carbonic acid.

We treat the gas with bromine water, but not with bromine itself. If we use bromine as given in some of the books, we get the most erratic results. When the action is over, and this has been washed away, the reading must be taken. The washing has brought it down to normal temperature. This represents the hydrocarbons chiefly of the ethylene group. The oxygen is absorbed by first adding a solution of pyrogallic acid (1 in 3 of water), and then running in about five times its volume of the strong potash solution. As the absorption of this gas is slow, this part of the process should be repeated, to make sure that the absorption is perfected; and during this experiment, a little increased temperature is desirable. This estimation may be made with advantage after the carbonic acid determination.

The tube is thoroughly washed, and under any circumstances a careful reading is taken. The copper solution is now introduced, and the difference, after bringing to the normal temperature, shows the percentage by volume of the carbon monoxide gas. This solution may be made in many ways. The cuprous chloride can be procured in commerce; but as it is not a very reliable salt, I cannot recommend its use. Cuprous oxide may be used; and for this purpose, 103 grains of cuprous oxide, 86 grains of water, and 1000 grains of pure hydrochloric acid are mixed in a stoppered bottle. A spiral of copper wire is always inserted.

The solution that I use, however, is made by taking the green crystals of cupric chloride and treating it with copper. You will observe that, on dissolving these crystals in hydrochloric acid, we get a bright green solution. Directly I add this piece of copper foil, it begins to get a brownish colour, which is in a short time almost black. If the tube is closed, it becomes in time water white, the cuprous salt being produced thus: Cupric chloride + copper = cuprous chloride ($Cu Cl_2 + Cu = Cu_2 Cl_2$).

Such a tube on opening becomes brownish black, and an interesting experiment may be performed similar to the blue ammoniacal solution.

There must evidently be some intermediate decomposition; but what that is, is hardly understood. For the purposes of gas testing, we may take the following proportions: About 150 grains of cupric chloride crystals (which generally contain about 22 per cent. of water of crystallization) are dissolved in 80 grains of water and 1000 grains of pure hydrochloric acid. Some long strips of copper foil are added. The bottle should then be closed and inverted. It is left until next morning, when the solution should be colourless, or nearly so. The bottle should be almost full. This process is not given in any of the books. The experiments are noted as follows:—

Observations.	Reading.	Remarks.
0·6	0·6	Correction for excess over zero
Potash Sol. 3·6	3·0	Per Cent. CO_2
Pyro. Sol. 4·2	0·6	,, O
Br. Water 10·6	6·4	,, Hydrocarbons
Copper Sol. 26·4	15·8	,, Carbon monoxide.

Mr. Allen has recommended that we should work with brine in place of water. This is quite superfluous if our object is estimating carbon monoxide alone.

In conclusion, I may state that there are some details which would take too long to give here. The original points in this paper, although few, will, I think, be found of value.

Mr. J. M'Grath (Cork) moved a vote of thanks to Professor Tichborne for his excellent lecture.

Mr. C. B. Tully (Sligo) seconded the motion. He said the subject was a very interesting one, and he hoped the lecture would stimulate members to follow out this part of their business—gas analysis—in their works. The necessary apparatus could be purchased for a very small sum—he supposed £5 would about cover it. In his experiments with water gas, he used the same apparatus as that which Professor Tichborne had described, except that he found it necessary to go rather farther than the lecturer had done. That was to say, he absorbed out the benzine with nitric acid, mixed the residue with oxygen, and exploded. He could assure members that when once they tackled this subject there was no end to it. It was very interesting indeed.

The President (Mr. S. B. Langlands) thought they were indebted to Professor Tichborne for having taken Professor Macadam's place at such short notice.

Professor Tichborne expressed his obligations to the members for the complimentary way in which they had spoken of him.

THEORY OF THE INCANDESCENT MANTLE.

By A. H. White and A. F. Traver.

[**Contributed by the Chemical Laboratory of Michigan University to the New York Section of the Society of Chemical Industry.***]

In previous studies published from this laboratory, dealing with the phenomena connected with the incandescent gas mantle, the influence of the heating value of the gas upon the amount of light emitted, and the conditions for highest efficiency with a given mantle, have been investigated with some thoroughness, and the question of the temperature of the mantle has received a preliminary treatment.† It is the purpose of the present paper to present further data on the temperature of the flame and the mantle, the relation existing between the temperature and illumination, and to discuss the question as to whether the illumination is a pure "temperature" effect or whether other agencies come into play.

The temperatures reported in the former paper were obtained by Le Châtelier thermo-couples of comparatively fine diameter (0·19 and 0·25 mm.). It was recognized and stated that the temperatures thus recorded were necessarily low, owing to radiation from the wires; but the correction necessary to obtain the real temperature was unknown at that time. We have since been able to determine this correction. To obtain it we used a series of five thermo-couples, made from the same stock of wire, of diameters varying from 0·05 to 0·33 mm. These couples were standardized with great care; the ultimate standard being a thermo-couple calibrated by the Reichsanstalt. Electromotive forces were determined by a direct-reading reflecting galvanometer permanently installed in a separate room. This galvanometer has been in use for the purpose for several years, and has proved itself an extremely reliable instrument. It was calibrated just before this series of measurements and again at the close, and had not changed. [The authors described at length the method of standardization.]

Before proceeding to discuss measurements of mantle temperature, it is necessary to show that these thermo-couples as we have used them, when placed against the mantle, allow us to determine with considerable certainty the mantle temperature. The couple and its wires are placed vertically in direct contact with the mantle, but a large part of the surface of the wires is necessarily in contact with the gas, and not with the mantle. The interchange of heat between two solids is, under mormal conditions, relatively rapid compared with the interchange between a solid and a gas; and the couple would tend to attain more completely the temperature of the mantle than of the gas. In order that the couple should be of a markedly different temperature from the gas, there must be some source of heat loss or increase which affects the wires in a different degree from the mantle. Our discussion is limited to a small area of the mantle in its hottest zone, and the thermo-couple and the portions of the wires in direct proximity to it. The thermo-couple may lose heat by conduction, convection, and radiation. To minimize the loss of heat from the couple by conduction, we placed not only the couple in contact with the mantle, but also its wires, so that they were heated to redness for a distance of about 2 inches from the couple. In order that loss of heat may be experienced by the couple through conduction, it is necessary that the influence of the cold conducting wires should extend through the 2 inches of hot wire at practically the same temperature as the couple. We believe that this almost eliminates the error, even for our larger wires. In any case, the heat conducted away will vary with the cross section of the wires, will decrease rapidly with wires of diminishing diameter, and will become zero with a wire of infinitely small diameter.

The loss of heat due to convection has also been very largely eliminated by the method of experiment employed. In these experiments, where a chimney could not be used because of the difficulty of properly placing the couples, the air currents move so sluggishly that the zone of secondary combustion, instead of being at the surface of the mantle, is removed to a zone at a distance of about 2 mm., where a much hotter temperature is noted than on the mantle. Cold air currents, therefore, in order to cool the couple, would have to break through this continuous zone of flame, and, as is actually the case, would become somewhat hotter than the couple. They would thus tend to warm instead of to cool it.

There remains to be considered the loss of heat by radiation. Radiation from the wires will vary with the surface, and for a

* Reprinted from the "Journal of the Society."

† See "Journal," Vol. LXXVII., p. 879; and Vol. LXXIX., p. 892.

given temperature the loss of heat from a small wire will be less than from a large one. The wire receives most of its heat by direct contact with the mantle. This surface is a narrow strip, theoretically a line, independent of the size of the wire. The amount of heat received by the wire is therefore practically a constant, whatever the size of the wire. The loss by radiation decreases directly as the surface—that is, as the diameter of the wire—and is a linear function. Hence, by using wires of progressively smaller diameter, we should get increasing temperatures, and in the limit for a couple of infinitely small diameter should eliminate entirely any loss by radiation, and attain the correct temperature. This theoretical view of the case has been confirmed by experiment.

Evidence was given in the previous paper showing that when a fine thermo-couple was placed against a mantle, the thermo-couple would record the temperature of the mantle and not of the flame. Some of the evidence may be repeated. A fragment of a mantle, about ½ inch wide and 1 inch long, was suspended by a fine platinum wire in the flame of the burner, so that it was surrounded on all sides by the flame. A thermo-couple 0·19 mm. in diameter, placed vertically in the flame about 1 mm. from the surface of this fragment, showed a temperature of 1453° C. When moved over slightly, so that the couple and wires were flat against the fragment, the temperature dropped to 1353° C. The free flame, a similar distance on the other side of the fragment, showed 1430° C.; while the couple, moved over slightly until it was flat against the mantle again, showed 1353° C. The couple then shows a difference of 90° when placed against the mantle or in the free flame. This difference can be due only to the mantle being colder—a difference which the couple indicates perhaps incompletely, but decisively.

In order to more closely follow the conditions prevailing in actual use, a slit about ½ inch wide was cut vertically out of a mantle from near the top down almost to the level of the cap. This allowed the couple to be introduced to get the temperature of the inside of the mantle. The wires were bent at right angles, so that about an inch of the wires above the couple was in contact with the mantle, both in measurements inside and outside. According to one experiment, the temperature of the free flame on the inside 1 mm. from the mantle was 1523° C.; with the couple touching the mantle on the inside, 1373° C.; with couple touching the mantle at the same point on the outside, 1370°; with the couple moved 0·5 mm. off the mantle on the outside, 1360° C.; 1 mm. off, 1342° C., &c. This decrease in flame temperature on the outside is due to the large opening in the mantle through which passed a considerable part of the gas that would normally have gone through the meshes of the mantle. Experiments like the above, repeated at different times and with different mantles, have shown that the thermo-couple, when placed in contact with a mantle, will, in every case, indicate clearly a large difference between the temperature of the flame and of the mantle.

In making the measurements in the series of tests here recorded, the same burner was used, the mantles being transferred to it successively. Each mantle had been burned for at least 24 hours before testing, but had not been in use for a much longer time. The gas consumption, pressure, and all other conditions pertaining to the burner were kept as constant as possible throughout the series. The gas used was from the city mains—an uncarburetted coal gas, the composition and heating value of which are unusually constant. In making the temperature measurements, the couples were placed vertically; the couple touching the mantle at its hottest portion, and the wires closely fitting the mantle, so that they were heated to redness for a distance of about 2 inches. Measurements of mantle temperatures made in this way may be duplicated with great accuracy. Each temperature reported is the mean of at least three observations; the couple being withdrawn from the flame each time, and then reset at the same point on the mantle. Results thus obtained will duplicate within 5° of one another. In order to fit the couples on the mantle, it was necessary to dispense with a chimney. The absence of the draught caused by the chimney renders the combustion at the surface of the mantle much more sluggish, so that the hottest zone of the flame is at a distance of 1 mm. to 2 mm. from the surface. In a mantle burning under its most favourable conditions, this zone of combustion is right at the surface of the mantle. This necessary deviation from ordinary practice is in some respects to be regretted; but the presence of a hotter zone outside the mantle prevents any possibility of the couple being cooled by air currents.

In making these measurements, as in the standardization, the junction between the wires of the couple and the copper leading was kept at 0° C.; each junction being placed in its own small dry test-tube immersed in ice water. This precaution of placing in separate dry tubes was found to be necessary in the case of the 0·05 mm. couple, where a slight electromotive force was noticeable when both junctions were immersed in the same bath of ice water. This action was less noticeable with the 0·10 mm. couple, and could not be detected with couples of larger diameter.

The following tables and diagrams show the results of measurements of two different mantles and the corresponding flame temperatures. The two mantles were furnished to us for these tests by the Welsbach Company; No. 1 being pure thorium oxide, and No. 2 being composed of 99·5 per cent. of thorium oxide and 0·5 per cent. of cerium oxide. With this exception, the two mantles are supposed to be identical; and no differences can be detected by photomicrographs. The gas pressure was held constant at 17-10ths throughout the tests, and the consumption as close to 3 cubic feet per hour as possible; this figure being chosen after experiment had shown it to give the highest illumination. The couples were placed against the mantle in the hot zone, about 18 mm. above the bottom of the mantle, and by repeated trials the wires were bent so that they fitted the mantle closely, while the couple was exactly on the mantle. After the measurement of the mantle temperature, the couple was withdrawn until by experiment the highest temperature of the flame burning outside the mantle at that level was found. These measurements were made at least three times. The next couple was then inserted, and the procedure repeated. After all the couples had been used, the first one tried was introduced again to make certain that the conditions had not changed during the test.

With each of these mantles a test was also made with forced draught; the air supply being adjusted till the thermo-couple showed that the mantle was hotter than any point off it. This is the condition obtained in actual practice when a proper chimney is used; and the candle power shown by this method is closely that obtained from these same mantles when a chimney is used. With mantle No. 2, immediately after completing the tests, the mantle was removed from the burner, and the maximum temperature of the flame was taken at exactly the same height above the burner as with the mantle.

Candle-power determinations were made with each test, both of the light of the whole mantle and the light from a small area of practically constant temperature in the hottest zone, in the centre of which was placed the thermo-couple. This is recorded in the tables as candle-power "slit." The light from the rest of the mantle was cut off from the photometer by a screen with a rectangular slit, 0·342 square inch in area. Details of the arrangement are furnished in our former paper. The numerical data are given complete in Table I. Diagram A shows graphically the temperature curves for mantle No. 1, and Diagram B does the same for mantle No. 2. In these diagrams the abscissæ represent temperatures in C°, and the ordinates the diameters of the wires used expressed in hundredths of millimetres.

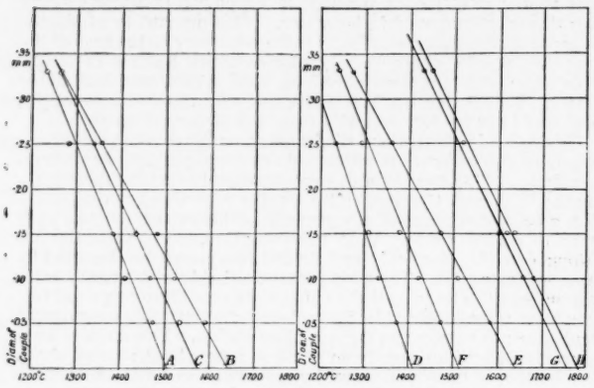
It will be noted that there is an increase in temperature recorded by each successively finer thermo-couple, and that the points lie with fair regularity on a straight line. This is in agreement with the theory previously stated. The authors believe that the points obtained by continuing these lines to zero diameter give the temperature which would be attained by a couple not affected by loss of heat due to conduction, convection, or radiation, and that the temperature thus indicated may be accepted as correct. By reference to the two diagrams it will be seen that the lines representing the flame temperature outside the mantle (lines B and E) have a different slope from the others. This is due to the method of experiment. As these temperatures were taken alternately with measurements on the mantle, the wires were left bent as they fitted the mantle. In this position, when they were moved into the outer flame envelope the wires were not heated for so great a distance above the couple, and there was evidently some loss of heat from the couple by conduction or convection—a loss which is greater for couples of larger diameter and makes itself evident by change in the slope of the line. In the temperature

TABLE I.—*Temperature and Illumination.*

	Mantle No. 1 (Pure Thoria).			Mantle No. 2 (99·5 per Cent. Thoria, 0·5 per Cent. Ceria).			Mantle Removed, Free Flame.	
Thermo-couple.	A. Mantle Temperature, Natural Draught.	B. Flame Outside Mantle, Natural Draught.	C. Mantle Temperature, Forced Draught.	D. Mantle Temperature, Natural Draught.	E. Flame Outside Mantle, Natural Draught.	F. Mantle Temperature, Forced Draught.	G. Free Flame, same Position.	H. Free Flame, Maximum Temperature.
	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.
0·33	1234	1266	1263	1168	1270	1240	1430	1450
0·25	1285	1355	1343	1230	1360	1295	1505	1518
0·15	1385	1480	1434	1313	1468	1377	1598	1638 / 1615
0·10	1405	1527	1470	1329	1515	1420	1655	1675
0·05	1480	1590	1535	1330	1581	1470	..	..
	Candle Power.				Candle Power.			
Slit	0·2	..	1·3	4·0	..	11·6	..	..
Total	1·2	..	3·4	15·7	..	29·1	..	..

of the free flame in Diagram B (lines G and H), the wires were bent so that they fitted the flame; and the lines have much the same slope as those representing mantle temperatures.

DIAGRAM A. (MANTLE No. 1). DIAGRAM B. (MANTLE No. 2).



Temperatures as determined by thermo-couples of varying diameters.

A, D. Mantle Temperature, Natural Draught. B, E. Flame Temperature Outside Mantle, Natural Draught. C, F. Mantle Temperature, Forced Draught. G. Free-Flame Temperature. H. Maximum Free-Flame Temperature.

Thermo-couples of varying diameters have also been used to measure flame temperature by Mr. E. L. Nichols, with the difference that he placed his thermo-couples horizontally with only the tip in the flame, so that the loss of heat by conduction along the wires prevented his couples from attaining the flame temperature as closely as did ours. Nevertheless, the result given by him, of 1775° C. for the non-luminous envelope of a luminous gas-flame, agree almost perfectly with the 1780° C. we obtained with a bunsen flame. The temperature of the mantle has been determined by Le Châtelier, who compared spectro-photometrically the light from a portion of a mantle with that from a flattened disc of a thermo-couple 1·5 mm. in diameter, covered with the same mixture of oxides. The temperature of the thermo-couple was gradually raised till the intensity of the chosen wave-lengths, from its surface, was as nearly as might be that of the mantle. Under these circumstances, the mantle was held to be at the same temperature as the thermo-couple. Temperatures thus obtained varied from 1590° C. to 1710° C. according to the wave-length chosen for comparison, averaging 1650° C. Lummer and Pringsheim, on the assumption that the mantle behaves approximately like a black body, have, by pure photometric means, placed the temperature at from 2450° C. to 2200° C. absolute, or from 2177° C. to 1927° C. Our measurements of mantle temperatures are in very fair agreement with Le Châtelier's. The gas we are using is of rather low calorific power; but we have determined temperatures of commercial mantles, burning under normal conditions, to be as high as 1580° C.

The most interesting point in these results is the fact that No. 1 mantle, of pure thorium oxide, attains a temperature of 1510° C., and has an illuminating value of 1·2 candles, while No. 2 mantle shows 15·7 candles, with a temperature of only 1404° C. These experiments were made using the same burner and the same gas consumption and pressure. The maximum temperature of the flame burning outside the mantle is closely the same in both cases; being only 12° higher in the case of the mantle having the higher temperature. This relation between illumination and temperature is in direct contradiction to the theories of Nernst and Le Châtelier, who hold that the illumination from a mantle is a function of temperature alone. Yet we find that the mantle which has the lower temperature by 100° C. gives thirteen times the light the other does. It is evident that the illumination here is dependent to a greater degree upon some specific property of the mantle than upon the temperature. It appears as if the No. 2 mantle containing 0·5 per cent. of cerium oxide was acting as a transformer. It receives the same amount of heat energy as the No. 2, does not attain so high a temperature by 100° C., and emits thirteen times the light. The fact that the flame burning outside the mantle has practically the same temperature in both cases indicates that the energy abstracted by the mantle from the flame is practically the same in both cases.

It is, therefore, worth while to consider whether there is any correspondence between the larger amount of energy radiated by No. 2 as light and the larger amount of heat radiated by No. 1. The marked inequalities in temperature and illumination between the various portions of the same mantle have caused us to consider only the small area of 0·342 square inch. This area has been calculated to be 4 per cent. of the total area of the mantle; and it has been assumed that 4 per cent. of the total heat of the gas burned passes through it. The gas consumption was 3 cubic feet per hour, and from this the volume of combustion gases was calculated; the chemical composition of the gas being known, and theoretically complete combustion being assumed. The temperature on the inside of the mantle was experimentally determined to be 1600° C. We now have the amount and composition of the gases passing through the unit area of mantle, and the temperature of these gases before and after passing through the mantle. The energy may be calculated from these data and the specific heats of the gases in question. The specific heats used were those given by Ihering in the "Journal für Gasbeleuchtung" in 1901 (Vol. XLIV., p. 66), as harmonized from the results of Berthelot and Le Châtelier. The results may be summarized as follows:—

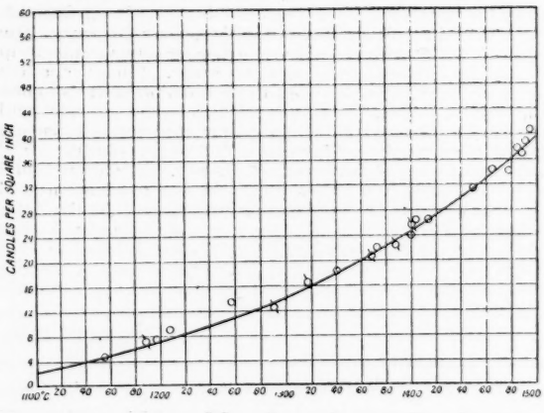
——	No. 1.	No. 2.
Temperature on inside of mantle	1,600° C.	1,600° C.
Temperature on outside of mantle	1,510° C.	1,410° C.
Heat conveyed to unit area of mantle (calories per hour).	15,790° C.	15,790° C.
Heat conveyed from unit area of mantle	14,380° C.	13,170° C.
Heat transformed by unit area of mantle	1,410° C.	2,620° C.
Illumination per unit area	0·2 cand.	4 cand.

We have a difference in the heat transformed by this unit surface of the two mantles of 1210 calories per hour or 140·10⁵ ergs per second. This is for a mantle surface of 0·342 square inches, or 2·20 square centimetres. For 1 sq. cm. the difference in energy transformed would be 64·10⁵ ergs per second, and the difference in light emitted 1·7 candle power.

According to the measurements of Tumlirz, the mechanical equivalent of the light from a Hefner lamp is 1·51·10⁵ ergs per second. Thus, if all the 64·10⁵ ergs per second were converted into visible light, we would have 42 Hefners, or 37·2 candle power as the difference in illumination between these two mantles per square centimetre of surface in the hottest zone. Actually the difference per square centimetre is 1·7 candle power, or 4·5 per cent. of the theoretical. This is nearly twice as large a percentage as in the Hefner lamp, where, according to the same authority, only 2·4 per cent. of the total energy produces visible light.

Although the illumination from a mantle is not the same as would be afforded by a black body at the same temperature, the illumination given by an individual mantle varies with its temperature; and we have been able to determine approximately the extent of this variation for a limited range of temperature. For these experiments one mantle and burner were used, and one couple; the temperatures obtained being afterwards corrected to a couple of infinitely small diameter. The illumination and temperatures were measured for a small area as before described, and the illumination calculated to candle power per square inch. The differences were brought about by enriching the gas or diluting it with nitrogen or carbon dioxide. Two different series of experiments were made—one using a rectangular aperture in the screen of 0·342 square inch. As it was feared that this area might be so large that it could not be at a uniform temperature, a second series was made with a smaller circular screen aperture of 0·110 square inch (0·710 square centimetres). The results of both series are calculated to candle power per square inch of mantle surface, and given in Diagram C; the series made with the smaller aperture being indicated by a line through the circle. The agreement existing between the two series is all that could be expected.

DIAGRAM C.—*Variation in Candle Power of a Mantle with Change of Temperature, expressed in Degrees Centigrade and Candle Power per Square Inch of Mantle.*



In studying the causes of the exceptional illumination of the mantle, it seemed worth while to see whether a mechanical mixture of thorium and cerium oxides might act differently from the oxides obtained by igniting the mixed nitrates. No way suggested itself for testing this on a mantle; but it seemed likely that some information might be obtained from the behaviour of thin pats of oxides exposed to the flame. Mixtures of oxides were accordingly made into a paste with sugar solution, and moulded into pats about 6 mm. long, 4 mm. wide, and 1 mm. thick. A thermo-couple 0·20 mm. in diameter was pressed into each pat, the couple being about 2 mm. from the bottom, and the wires being completely bedded in the pat for about 4 mm. After this pat had been dried and gently ignited, it was hung in the hottest portion of the

flame of a Welsbach burner placed on the photometer bench. Any change in temperature or illumination could thus be studied. Unfortunately, the unavoidable inequalities in the thickness of the pats and the position of the couple render great caution necessary in comparing the temperatures obtained in the different experiments with one another. One series of experiments was made, starting with a commercial chemically pure thorium nitrate and cerium nitrate. Each of these was ignited separately, and portions of the ignited oxides in the proportion of 99 per cent. of thorium oxide to 1 per cent. of cerium oxide were ground together. A solution of the nitrates was mixed in the same proportions, evaporated to dryness, and ignited. The results of tests made with these materials are given in Table II. The pats were examined frequently during the first few hours, and then at longer intervals. They remained in the flame until they had ceased to make any notable change in twelve hours.

TABLE II.—*Tests of Pats in Flame.*

Material.	Initial Conditions.			Final Conditions.			
	Temperature.	Candle Power.	Hours Burned.	Temperature.	Candle Power.	Change in Temperature.	Percentage Change in Candle Power.
	°C.			°C.		°C.	
Thorium oxide .	1309	0·19	60	1335	0·17	+ 24	− 10
Cerium oxide . .	931	..	50	996	0·019	+ 65	..
99 thoria 1 ceria (mechanically mixed)	1146	0·17	189	1262	0·29	+116	+ 70
Duplicate . . .	1120	0·19	158	1240	0·44	+120	+130
,, . . .	1021	0·10	120	1230	0·33	+209	+230
99 thoria 1 ceria (from mixed nitrates)	1210	0·30	17	1221	0·30	+ 11	..
Duplicate . . .	1135	0·14	92	1176	0·19	+ 41	+ 35

An inspection of these figures shows that all have increased in temperature. The pats shrink noticeably in the flame, becoming very dense and hard, and hence better conductors for heat. The rise in temperature indicated by the thermo-couple in the case of the pure thoria, pure ceria, and the thoria and ceria from mixed nitrates, is ascribed to this cause. The change in illumination with these same pats varies from a loss of 10 per cent. to a gain of 35 per cent. The behaviour of the mechanically mixed thoria and ceria is in marked contrast to the others. The rise in temperature is much greater than in the other cases, and extends over a longer period, while the illumination increases wonderfully—varying from a minimum increase of 70 per cent. to a maximum of 230 per cent. This exceptional increase takes place gradually, and can be due only to some slowly progressing change, which may most simply be held to be a gradual solid solution of the ceria in the thoria. In the case of the oxides obtained by the evaporation of a solution of thorium and cerium nitrates and subsequent ignition, it seems that solution is already complete, for the increase in temperature is no more than in the case of a single oxide, although the increase in illumination does in one case reach 35 per cent. Inasmuch as this series was made entirely on oxides prepared by ignition of the nitrates in a crucible, and it was possible that the physical condition of the oxide might be different from that of oxides from mantles, another series of tests was made with pats made from mantles. One of the pure thoria mantles furnished by the Welsbach Company was gently burned off and then ground up and made into pats. A new mantle containing 99 per cent. of thorium oxide and 1 per cent. of cerium oxide was similarly treated. The results are given in Table III.

These pats all show some decrease in illumination, which is accounted for, at least in part, by the shrinkage in the surface of the pat, amounting in one case to 33 per cent. Though, as we have previously stated, comparison of temperature between the various experiments must be made with caution, we call attention to the fact that in each series the highest temperatures are those with pats made from pure thorium oxide. Le Châtelier has in a somewhat similar way determined the temperature attained by a thermo-couple coated with various oxides and placed in a flame. His experiments show that a couple coated with oxides from a Welsbach mantle attained a higher temperature than one coated with oxide of thorium alone or with any other oxide, and he has founded his theory of the incandescent mantle to a large degree on this. He holds that since the mantle emits a relatively small amount of energy as red rays, the proportion of energy radiated in the form of visible radiations is consequently very large; but the absolute value of the energy thus radiated in luminous form is less than that which would be

TABLE III.—*Tests of Pats Made from Mantles.*

Material.	Initial Conditions.			Final Conditions.			
	Temperature.	Candle Power.	Hours Burned.	Temperature.	Candle Power.	Change in Temperature.	Percentage Change in Candle Power.
	°C.			°C.		°C.	
Thorium Oxide	1468	0·56	17	1486	0·40	+ 18	− 30
Duplicate	1522	0·55	3	1528	0·45	+ 6	− 18
,, ...	1584	0·62	71	1535	0·45	− 49	− 27
99 Thoria 1 Ceria	1408	1·08	21	1451	0·87	+ 43	− 20

emitted by a black body at the same temperature. But a black body placed in the same conditions of heating, and with the same extent of radiating surface, would have a much lower temperature and only a feeble illumination.

If we assume that the mechanical mixture of thoria and ceria has by long heating gradually changed into the same substance as is present in a mantle, the great rise in temperature and illumination which it undergoes during the change is entirely in accord with the theories of Le Châtelier and Nernst, who hold that the mantle attains a higher temperature than any other substance when placed in a flame, and hence emits more light. But, according to our experiments, both on mantles and pats, the pure thoria attains a higher temperature than the mantle oxides. If the illumination was purely a "temperature" effect, the pure thoria mantle (see Diagram A) should have higher illumination than that containing 0·5 per cent. of ceria, because its temperature was 100° higher. Instead, it gave only 1-13th the light. Similarly the pats made from pure thoria showed in every case a higher temperature than a pat of the same thoria with ceria, but yet in every case the pure thoria pats gave the lower illumination. The conclusion seems to us irresistible, that the illumination is to a greater degree a specific function of the material than it is of temperature, and that the mantle is acting as a transformer, which is more economically changing the heat of the flame into light than any other substance yet known.

The results may be summarized as follows: The temperature of the commercial mantle burned under usual conditions will vary from 1500° to 1600° C. For any single mantle, the illumination will vary with the temperature, as shown by the curve in Diagram C. For different mantles, the illumination will depend to a greater degree upon the composition of the mantle than it will upon the temperature. The mantle with the highest temperature does not necessarily give the most light. A mechanical mixture of thorium and cerium oxides, when exposed to a flame, gradually increases in temperature and illumination, till these approximate what would initially be shown by oxides prepared from the mixed nitrates; but the temperature remains below that which pure oxide of thorium would attain in the same flame. It is concluded that the exceptional efficiency of the mantle is due to a solid solution of the oxide of cerium in the oxide of thorium, and that this substance is capable of transforming the heat of the flame into light more economically than a black body or any other substance yet known.

GAS-COOKERS—DESIRABLE TO GAS COMPANIES AND CONSUMERS.

By D. W. SYME, of Naas.

[A Paper read before the Irish Association of Gas Managers.]

It is with a desire towards increasing the sale of gas through the medium of gas-cookers that I come before you to read this paper to-day. We live in an age of competition; and it is most deplorable to see the lack of attention generally shown by gas companies where their own interests are concerned. I admit that of late years a good deal has been done in the way of pushing gas-cookers; but, to the discredit of our profession be it said, fully 95 per cent. of this pushing has been done by the enterprising manufacturers of gas-cooking appliances.

Gas companies are formed for the purpose of making and selling gas; and I am persuaded no better method of selling gas exists than that of encouraging the use of gas-cookers. Now, seeing that we have so much practical proof to support us in this theory, I hold that it is the duty of everyone who is desirous of benefiting the gas industry to leave no stone unturned in order that gas companies may be made aware of the importance of this subject, with the result that they will acknowledge that gas-cookers are most desirable. It is obvious that, where gas is available,

the condition of the people generally would be improved by using cookers.

During the summer months, managers (especially managers of small works) are often discouraged by the exceeding great amount of unaccounted-for gas. Apart from condensation, I believe that the chief reason for this lies in the fact that during non-lighting hours a fair amount of pressure has to be maintained in the mains for the sake of supplying a few straggling cookers, and perhaps an isolated gas-engine. The leakage is thus abnormal; and in the almost microscopical output there is no compensation. If we reason from results already obtained by the use of gas-cookers, then we can have no hesitation in trying to convince our respective companies that to encourage the sale of gas for cooking is a most profitable and safe investment; and with such facts before them, there can be no excuse for a gas company adopting a "penny wise and pound" foolish policy, thereby crippling their own sources of revenue and handicapping their managers.

We have all heard of dividends being made in the retort-house. We can heartily endorse this, provided we get a sale for the gas. But the day of waiting in our works for consumers to come to us is past; and any gas company that hesitates to encourage and advocate the use of cookers may hold itself ready for disaster. I believe the policy of supplying the people with cheap gas for cooking purposes is a good one, seeing that it is an inducement to the use of gas in a wholesale manner; and I invariably find that the nearest way to a man's heart is through his pocket. Much can be done by going from house to house, instructing consumers in the use and advantages of the modern gas-cooker. Personally, I favour coming in contact as much as possible with consumers, thereby proving myself interested in their requirements. Thus we can gain their confidence; and the adoption of gas-cookers generally follows.

When the summer weather is oppressive, the coal fire with its superfluous heat is no desirable acquaintance. Yet, strange to say, people hesitate about adopting gas-cookers; the general idea being that cooking by gas is very expensive. Now, nothing could be further from the truth; for my experience convinces me that, with gas at 5s. per 1000 cubic feet, in houses where it is used for all general purposes, the gas bill never exceeds 10 per cent. under a penny per head per diem. This compares favourably with coal at an average price; and we know that in Ireland, as a rule, the price of coal is excessive, owing to freight, &c. It may not be generally known, yet it is an acknowledged fact, that a joint cooked by the ordinary coal fire will weigh much lighter than if cooked by the gas-oven. In cooking at the coal fire, the outside of the joint is scorched before the centre is reached by the heat, and thus the natural juices are expelled, and the most valuable portion of the roast meat is converted into a fibrous, sapless, and practically indigestible mass.

Now, reflect for a moment. Let us imagine a portion of this reaching the stomach of a human being. What an extra amount of gastric juice it will require to reduce it to a pulp, and what an extra amount of hard labour it will inflict on the digestive organs. With an up-to-date gas-cooker, all this is reversed; for the oven being heated to a sufficient degree, the joint is surrounded by genial heat of a continuous uniform temperature deflected on all sides by the enamelled linings. The operator has complete control of the gas-cooker, a thing which is an impossibility with the best coal fire; and I hold that such control is absolutely essential to perfect cooking.

Another objection held by many is the ancient idea that food cooked by gas must retain a gaseous flavour. This is a physical impossibility; for every schoolboy knows that when cooking is going on evaporation is continually taking place, thus rendering it impossible for anything objectionable to be absorbed, much less retained, by food cooked by a gas-cooker. Gas is the spirit or vital principle of coal, and, being purified, must be much purer than the crude article from which it is taken. Gas-cookers have much to recommend them to consumers, especially when attached to slot meters; no heavy accounts to pay, no dust nor ashes, and no waste. They are always ready at any moment, day or night, and a gas-cooker, being economical, is the friend of the people and a boon to humanity.

These are a few of my own ideas concerning this most interesting branch of our industry; and I hope they may be instrumental in raising a discussion on this subject which may prove conducive to our mutual benefit.

Discussion.

The PRESIDENT (Mr. S. B. Langlands) said the meeting had had a practical and very solid paper, and he hoped they would be able to have a good discussion upon it. For his part, he might answer Mr. Syme on the question of having two prices for gas. He had already said, before the Association, that he thought the lighting consumers should get any benefit that was going. They were the backbone of the industry; and why should they give their benefits to consumers for heating and cooking, which were, as yet, only secondary purposes to lighting?

Mr. S. A. SCRIVENER (Dublin) thought that if the lighting consumers were the backbone of the industry, and were to get all the benefits, suppliers of gas would be neglecting more than half of their possible field. There were some places where the day consumption of gas was larger than the night consumption, which was only on for a short time; because from (say) eleven or twelve o'clock till about four in the morning they had no consumption, whereas it was going on more or less all day long. Further, gas might be used in the daytime for all kinds of purposes, not only domestic but manufacturing. He knew that in Ireland manufacturers had not the opportunity of experimenting with apparatus which might be tried in more populous manufacturing districts; but, at the same time, he thought there were few towns in which they could not create a consumption during the day, which would equal, or even exceed, the night consumption—showing that there was an unoccupied field. He thought this matter should be pressed upon those who had not yet occupied the field, in order that they might gain at least a portion of it.

The PRESIDENT said he was afraid Mr. Scrivener had misunderstood him. What he meant was the selling of gas for cooking and heating at a lower price than for lighting.

Mr. G. W. NORMAN (Dublin) pointed out that what the President said was that gas employed for cooking and heating was a secondary consideration. He wished to say, from his own private gas bill, that he spent about £6 upon cooking, as against about £4 upon lighting.

Mr. SYME thought the President had failed to grasp the object of his paper. He did not for a moment mean to leave lighting alone. He wished to bring out the fact that they did not always have darkness. He desired to see cookers pushed, so that they might have, as far as possible, a day and night consumption.

Mr. J. E. TOOMS (Waterford) said, while thanking Mr. Syme for his rather interesting contribution, he could not help thinking it was surprising that a paper like this should require to be read at all. Still, they knew that they could, each of them, put their fingers on places where cookers were unknown, in towns, perhaps, where the price of gas was high—say, from 6s. per 1000 cubic feet upwards. If they were making only 2 or 3 million cubic feet of gas a year for lighting, and they wished to do any business in cookers, they must make a differential price. He took it, therefore, that the question a manager had to consider was whether he should start to hire cookers. He noticed that Mr. Syme did not give them any information as to whether he was letting cookers on hire or selling them outright. He thought that in a small place it was useless to try to sell cookers to consumers who knew nothing whatever about them. From his experience with differential prices, he could say it was an utter impossibility to fix cookers and keep them up if the charge for gas was above 6s., unless they had a differential rate. He said this distinctly. Supposing they made a differential rate in a case of that kind, they would not do the consumers of gas for lighting any injustice, because if they did not introduce cookers, there was very little likelihood of the consumption increasing—at any rate, where there was very little industry in the district; and if they did introduce differential rates, the gas used for cookers or in the day time would be all extra, and it could be produced cheaper than the quantity they had been in the habit of making for consumers for lighting. He was familiar with several towns, some of them pretty large ones, in which gas-cookers were practically unknown four years ago; and the consumption had increased upwards of 100 per cent. in more than one of them since then. He therefore could quite agree with Mr. Syme that cookers were desirable to both companies and consumers; but they must hire them—at all events at the outset. The great point was to get a start, and they would get it in that way. If they belonged to a town where there were no cookers, they should, on starting, give the cookers their undivided attention, to see that there was no waste, and that the cookers got justice. He did not think it would do to let anyone else, even a subordinate, do the work. They should see that the first cookers were a success; and there was no doubt this would get bruited abroad, and business come in. That, at least, was his experience.

Mr. G. AIRTH (Dundalk) said, with regard to differential prices, he did not trouble himself about that matter, although he thought they should charge a lower rate for gas used for cooking. He found he had an increasing consumption, even in the past month, of something like 134,000 cubic feet, owing to starting cookers. In the last two-and-a-half years he had put in, he should say, more than fifty. When he went to Dundalk there were only about eleven. Some of these he persuaded people to buy; the others were rented. He would impress upon members not to try to take all they could out of a stove, because they were getting profit on all the gas they were making for these appliances, and they were selling it in the day time. It did not require any explaining that they were making a higher profit upon this gas. In his own case, it was considerable. To return to Mr. Syme's paper, he thought it was a very great advertisement—in fact, he noted some of the things from the mauufacturers' side; and he should like to ask Mr. Syme how he was to get customers in very small towns. They could not compel people to come and take a stove. Another thing—he thought it the hardest part of all—was how were they to get their bills paid? He found people did not like prepayment meters, especially in towns where there were differential rates—such, for instance, as those where they charged 3s. 9d. per 1000 cubic feet for gas for cooking. In those places, people did not want to pay 4s. 7d. per 1000 feet for lighting. If they could persuade a customer to have a stove, it was all very well; but he invariably tried to persuade people who would pay their bills to have one, because every good customer they induced to take a stove was an advertisement—they got on so well with them. He knew a lady in one town who procured nine customers

in less than three months, by simply talking up stoves. As to the gastronomic part of the paper, he would not trouble the meeting with any remarks upon it; but he thanked Mr. Syme very much for his communication.

Mr. W. DUNN (Queenstown) said he agreed with Mr. Tooms that the paper was hardly up to the status they expected in a meeting like that. He would like to have listened to one with more business in it. What was in the paper was just the thing every gas manager did.

Mr. H. KIRKHAM (New Ross) thought a lot of the paper was ancient history. He thought the Association would be doing really excellent work if they could get a good paper printed and circulated among the directors of the different gas companies; and if they had some statistics to show what had been done by the adoption of stoves, he considered it would be a rather valuable production. As to differential rates, they had in Cork an Exhibition. Supposing the Railway Companies kept up the same rates, would the Exhibition be as well patronized as it was at the present time, when excursions were coming in? They had a differential rate. Supposing the low rates were not granted, the Railway Companies would be out of pocket. Consequently, if suppliers of gas were able to pass a good deal more through a stove, even at a cheaper rate, it would pay them to do so. This was an old argument; but he thought it appropriate to the present case. Gas-cookers might pay some people, even when a high price was charged for gas—it all depended upon the way in which they were used; and a gas manager, or his wife, could easily show persons how to use them properly. When he said that he had only one stove, that was not the extent of his experience with these appliances. He had seen many stoves fitted. He had always thought that a griller over the top of a gas-range was a mistake, because few wished to boil and grill as well, The griller was very seldom used, as people generally preferred to fry.

Mr. DUNN considered the griller the finest thing about a gas-stove, as many people wished to have meat cooked that way.

Mr. G. CUMMINGS (Ballymoney) said he had had a little experience with gas stoves and cookers. It was about twenty years since he fitted up the first cooker, and he had been working at them ever since. To give the meeting an idea of the difficulty some gas managers had in getting them introduced, he would cite an instance. A lady asked him if he could give her something that would make breakfast in a hurry. He got a simple boiling-ring, and put a tap on the top of the kitchen bracket (about the middle of the arm) with a few feet of flexible tubing. She used it for about a year, and her gas bill was about 10s. more than in the previous twelve months. But what was the fact? Her coal bill was down £1. There was a prejudice against gas, and it was not easy to get a stove introduced. People often said that while they were well satisfied with gas-cookers they were far more so with coal fires.

Mr. R. YOUNG (Youghal) said he was not much of a believer in the griller on the top of a gas-range. So far as his experience went, it was not very successful. He found that far better results were obtained with a proper stove. Within the last month or two he had put in a number of stoves with prepayment meters; and the consumers were more satisfied.

Mr. T. J. REID (Ballina) congratulated Mr. Syme upon his paper. It had been said that such a paper was not necessary in an assembly of gas managers of this sort. At the same time, Mr. Syme had given them an account of his experiences. He (Mr. Reid) thought he was bound to have success with gas-stoves. As far as his own experiences were concerned, his were very small works, and he had had some difficulty in pushing gas-stoves. However, the matter was tackled in a common-sense fashion. He believed in differential prices for stoves, notwithstanding the President's remarks. He thought it was necessary to have them, to enable cooking by gas to compete with ordinary coal cooking; and he considered that if consumers were properly canvassed, and were shown that gas was cheaper than coal, they would accept the situation. But they must not stop at that. It was absolutely necessary not only to hire out the cookers, but to supply them free of all cost whatever to the consumers—at least, at first. By doing this, they had an advertisement for themselves and for their gas; and eventually they would find that people would become convinced of the benefit accruing by the use of these cookers, and would adopt them largely. In his town there were about thirty. This was, perhaps, not a very large number, compared with other places; but it was at least a beginning,

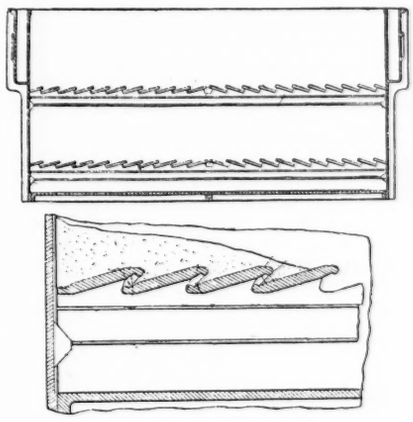
Mr. SYME, in reply, said he was much indebted to the members for the discussion which had taken place. As far as the accusation against him—that he had been in concert with the manufacturers of gas-cookers—was concerned, he could assure the meeting that there had been nothing of the sort. He had simply given facts as he had found them. Mr. Tooms asked him what had been done in Naas. He seemed to be wondering if anything at all had been done. Well, he had, during the past six months, put in about fifteen cookers. When he went to Naas, the output of gas was a little over 3 million cubic feet; last year he made fully 5½ millions. One of their big consumers adopted the electric light, and thought he was going to do away with the Gas Company. That customer got a high-pressure engine to produce electricity, and his gas bill was now more than ever. With regard to Mr. Kirkham's remarks, he (Mr. Syme) knew there were members who could write better papers than he could; he had simply given his experiences.

REGISTER OF PATENTS.

Purifier-Grids.—Faben, C. R., of Toledo, U.S.A. No. 11,490; May 20, 1902.

The patentee points out that gas-purifier grids are generally constructed with vertically disposed slats or bars, in the same horizontal plane, and spaced apart. Thus they "will not satisfactorily support the very fine oxide of iron employed, without there being mixed therewith an objectionable proportion of coarse inert material, such as planer chips, wood shavings, &c., which naturally reduce the bulk of effective purifying constituent in the material." On the other hand, the patentee's trays or grids are made of comparatively wide boards or slats overlapping one another at the edges, where they are vertically spaced apart to form horizontal, or nearly horizontal, gas-passages, and the upper face of each board has an upwardly projecting bead or flange near its edge to arrest the fine purifying material at the angle of repose, "so that ample provision is made for the flow of gas into and through the material, while the latter is prevented from falling down from the tray."

As shown, the purifier is provided with the interior brackets for supporting angle-bearings for the layers of grids. These are constructed of comparatively wide boards or slats seated on serrated boards or blockings E placed at their ends, along the walls of the box, and intermediately on the angle-iron beams. The serrated seating and spacing devices are made with long inclined bearings and upright bearings or spacing risers, so arranged that the slats shall be verti-



cally spaced apart at their overlapping edges, and that the overlaps shall be uniform and of sufficient extent to provide that the angle of repose of the purifying material will permit it to approach the edge of the slat. Since the boards are transversely inclined to provide for the vertical spacing to form horizontal gas-passages, it is necessary to provide the face of the slat, at its edge, with a longitudinal stop-device to hold the foot or base of the material at the angle of repose, so that the material shall not run over the edge of the slat. For this purpose, the face of the board, near its edge, is formed with a longitudinal depression, the bottom of which is inclined toward the base of the bead. The reverse side of the slat is preferably bevelled, so that the strip need not be so deeply serrated (and thereby weakened) but is made with a corresponding bearing surface as shown.

It will be seen that the slats are laid so as to be inclined upward and inward from the opposite sides of the box toward the middle, for directing the gas through the purifying material. At the middle, the adjacent slats rest at their inner edges on a bar.

Ventilation of Ships' Bunkers, Coal-Heaps, and the like, and Utilizing the Gas Generated for Motive Power, Lighting, and other Purposes.—Souheur, of Seraing, Belgium. No. 15,136; July 25, 1901.

This invention has for its objects to collect the gas given off generally, at any place where gas is liable to become accumulated, to isolate it from the surrounding air, and to store it for use in the production of power or otherwise.

The means suggested for carrying out the invention (drawing off and collecting the gas in the natural state) may, says the patentee, be classed under two heads—means for collecting and storing the gas at any point by portable light apparatus; and piping it with suction apparatus and gasholder near the orifice of the mine.

In the coal-bunkers of steamers, for instance, accumulations of gas may be prevented by introducing pipes at various depths into the mass of the coal and connecting them to a main duct communicating with an exhauster or pump, which serves to draw off the gas and force it into suitable receivers, whence it can be drawn off for use as required.

At places where large quantities of coal are stored in the open, the patentee suggests that it deteriorates, becomes oxidized, and burns slowly away; but by employing a "covered or closed magazine," and providing it with the means he describes, it is possible to prevent, in part, the losses just mentioned, and avoid the accumulation of gas in the coal and consequent danger of explosion.

The patentee closes his specification by remarking: "Any suitable arrangement of pipes, pumps, exhausters, and receivers for the gas may be employed, as will be readily understood without further explanation or illustration." But where, we may remark, is the novelty of the proposal, and therefore the "invention."

Retort-Settings combined with a Gas Producer and Regenerative Chambers for Heating the Secondary Air Supply by Means of the Waste Gases leaving the Setting of the Retort.—Herring, W. R., of Edinburgh. No. 15,397; July 30, 1901.

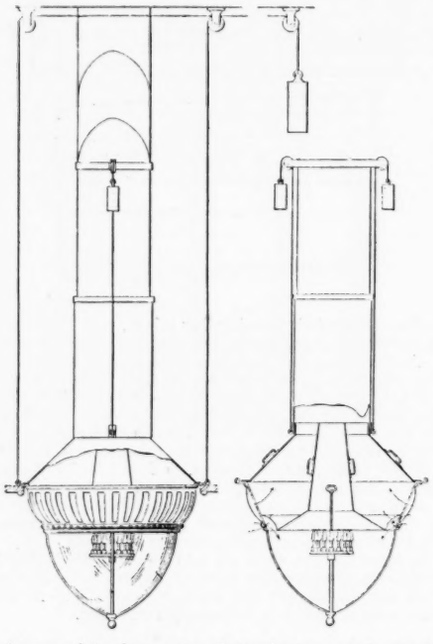
Extended reference to this invention will be unnecessary if readers bear in mind, or will refer to, the paper which the patentee read before the Gas Section of the Glasgow Engineering Congress last year. The paper appeared in the "JOURNAL" for Sept. 24; and the illustrations given on pp. 769-70 are practically the same as those accompanying the patent specification. The claims for the invention are, in effect, the retort setting combined with a gas-producer and regenerative chambers for heating the secondary air supply by means of the waste gases leaving the setting, as described and shown; air-heating chambers, made of specially-formed perforated blocks, as shown; the arrangement for joining the perforated blocks, as shown; and the construction of the blocks with projecting lips or flanges to support the transverse struts or bricks.

Incandescent Gas Lighting Apparatus.—Sugg, W. T., of Westminster. No. 16,275; Aug. 13, 1901.

This invention relates to the adaptation of "sun" lights for incandescent gas lighting.

As shown, the apparatus has externally much the same appearance as any ordinary "sun" light, except that the burners must be enclosed in a lantern carried by some suitable support—say, by cords or chains with a counterweight. The reflector (which is loose) has an upwardly extending outwardly curved flange to rest when in position on the inside of the fretwork which supports it and the chimney, the latter being provided with handles by which it may be lifted out when desired. An air space is thus left all round the reflector for the entrance of air to the lantern to support combustion, as indicated by the arrows.

The chimney delivers into a telescopic ventilating shaft; the moving part being carried by cords or chains with weights. The space



between the top of the fretwork and the bottom of the shaft is closed by a loose cover of conical form provided with handles, by which it can be removed, when required, to attend to the mantles of the burners.

The mounting of the burners is effected as follows: A tubular ring is provided with a number of nipples corresponding to the number of burners, whatever that may be, and is attached to a central boss by hollow cross-arms. This boss is formed with a socket to fit on to the top of the gas-supply pipe, and is also provided with a handle extending upwards, by which the ring of burners can be lifted off the gas-pipe, when necessary, for repair.

Preventing Leakage of Gas through the Walls of Retorts, Coke-Ovens, &c.—Koppers, H., of Carnap, Germany. No. 18,159; Sept. 11, 1901.

The present invention relates to "two-roomed heating appliances"—such as coke-ovens, retort-furnaces, or ovens for the manufacture of coal gas, muffle-ovens for the distillation of zinc, and recuperators—where it is desired to prevent the leakage of furnace gases into the chamber containing the material to be treated. The walls or partitions of heating appliances which have to resist high temperatures are (the patentee points out) generally made of refractory earthen or stone ware, which is porous, and easily permeable for gases, although the porosity may not be apparent at a glance. According to the pressure of the gases on the two sides of the porous partition or wall serving to transmit heat, a diffusion or leakage of gases takes place either to one side or to the other. But, in order to remove the porosity of these heat transmitters, he proposes to "fill the pores by mechanical means with mineral dust of the same or a similar nature as that of which the heat transmitter or partition is made." In the case of coke-ovens or gas-retorts, his suggestion is to blow into the heated coke-chamber or retort, when closed, a fine mineral dust at a suitable pressure. This dust remains suspended for a long time, gradually penetrating into the pores and cracks and closing them.

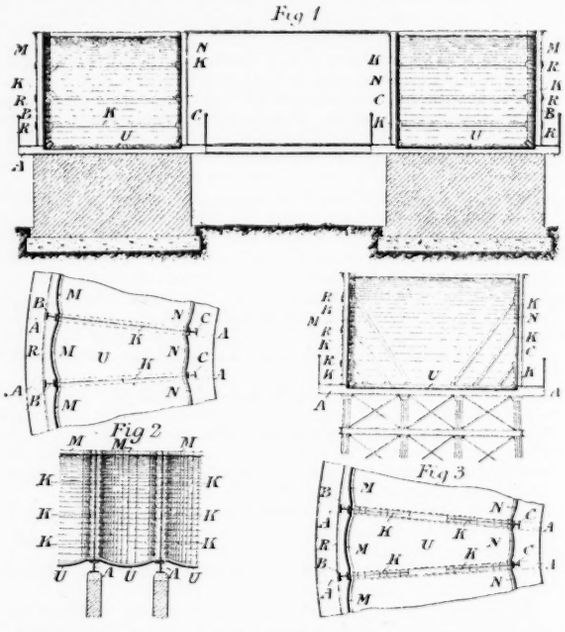
Construction of Tanks for Liquids.—Intze, O., of Aix-la-Chapelle. No. 18,242; Sept. 12, 1901.

The construction of large tanks of iron (for the reception of liquids) is attended with many difficulties, the patentee points out; "consisting principally in the construction of the lower parts of the cylindrical walls, which are mostly of very strong iron plates, and in their connection with the bed on the bottom of the tank, and in the construction of a supporting structure capable of transmitting a heavy load in an advantageous manner on to the supports, and also in the construction of the bottom of such tanks."

Both the diameter and the depth of tanks of ordinary construction for liquids are limited, he says, owing to these difficulties, and heretofore it has not been deemed advisable to construct single tanks of this description with a capacity beyond 2000 to 2500 cubic metres; while when it is desired to provide accommodation for larger quantities, two smaller tanks are generally used. A division into two parts of cylindrical tanks for very large quantities or for large diameters meets with special difficulties with regard to the divisions, mostly of cylindrical form, which form the compartments of the tank.

His invention therefore has for its object to obviate these faults. The tanks—whether erected on brickwork or iron structures—are composed of a number of constructional elements or frames and of depending corrugated or curved plates arranged in such a manner as to cover in the spaces between the frames.

Fig. 1 is a longitudinal section of an annular tank with brickwork



foundation. Fig. 2 is a horizonal and cross section. Fig. 3 is a radial cross section and a horizontal section of an annular tank supported on an iron structure.

The separate elements of the annular tank shown in figs. 1 and 2 consist each of a radially disposed horizontal beam A, an outer upright B, and an internal upright C, both connected with the beam A. The uprights may be arranged either vertically (as shown), or they may be inclined or also curved. By the inclined or curved disposition of the uprights, the capacity of the tank is materially increased. The spaces between each two uprights B and C are covered in by corrugated or curved plates M and N, of small radius and comparatively thin material, which transmit to the supports the horizontal stresses produced by the filling of the annular tank. The vertical load is transmitted by the base-plates U on to the carrier A, and by the latter on to the brickwork or iron structure supporting the tank. With a sufficient strength of the radial beams, the substructure of brickwork may (as shown in fig. 1 for example) be of annular form. By reason of the vertical corrugated or curved plates M and N, the radially acting horizontal stresses of the water pressure are transmitted on to the uprights B and C. These horizontal stresses are advantageously balanced as far as possible by stay-bars K disposed in vertical radial planes. These stays are placed horizontally between the corresponding or adjacent outer and inner uprights B and C. By providing a sufficient number of such bars, the tendency of the uprights to bend between the fixing points may be reduced, so that comparatively thin uprights may be used.

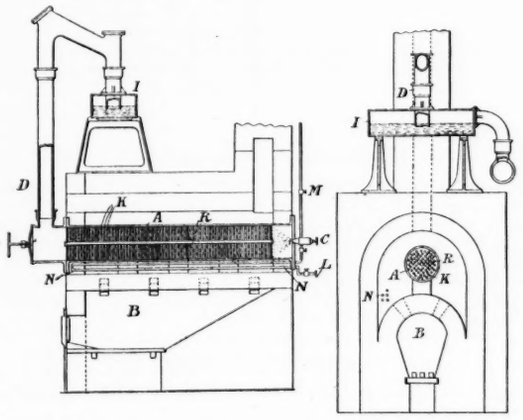
In the construction of the annular tank shown in fig. 4, the horizontal and radial water pressures, acting against each outer and inner upright B and C respectively, are transmitted, by diagonal stay-bars K, on to the horizontal beam A. It is thus possible to reduce the bending stress upon the horizontal beam A, and to transmit the vertical load more on to separate points of the radial support of the beam. The excess of radial horizontal water pressure, mostly very slight against the outer uprights as compared with that acting against the inner uprights, is

taken up by external tension rings or polygonal braces R, which are applied around the outer uprights B, as shown in figs. 1 and 2.

Producing Illuminating and Heating Gas.—Dibdin, W. J., and Woltereck, H. C., of Howick Place, S.W. No. 19,152; Sept. 25, 1901.

This invention relates to a process for producing "permanent illuminating or heating gas from a mixture of hydrocarbons and superheated steam, by means of highly heated metal; consisting in submitting the mixture of oil and steam, in proportions permanent during the operation, at a constant temperature, and by most intimate contact, to the action of metal adapted to serve as a carrier of oxygen."

The principal conditions for the successful execution of the process are said to be: (1) Maintenance of a constant temperature. (2) Maintenance of the proportions of oil and steam. (3) Most intimate contact with the contact material. If any of these conditions are neglected, the patentees remark, a gas will be produced which contains admixtures of a non-permanent character, which, on condensation, will "act as a stripping agent on the otherwise permanent gas, and the resulting gas will prove below the illuminating power required and entail considerable loss." It is said that, by the use of their process, they have been able to obtain "a permanent gas of 16-candle power, and a production of 100,000 cubic feet from a ton of crude petroleum."



The process is based on the decomposition of steam by iron or other suitable metal at high temperature producing hydrogen and metallic oxide. A portion of this oxide reacts with the hydrocarbon compounds in the oil, forming water and carbon monoxide, which reduces the remaining oxide back to the metallic state, under production of carbonic acid.

After remarking that, by altering the proportions of oil and steam according to the desired illuminating power, the quality of the gas may be greatly varied—with the minimum of oil required for the process of reduction, a production of about 200,000 cubic feet are said to be obtained of a gas of low illuminating power "but ideal quality as power gas in not containing any incombustible gases after purification (practically all carbonic acid being removed), and consisting chiefly of hydrogen, methane, and carbonic oxide"—the patentees conclude the general part of their specification in these words. "We have found it practical to employ the metal in the form of perforated discs, which may be strung on a central rod to enable them to be easily removed for inspection, and which should fit into the retort or other suitable apparatus employed as closely as possible."

In the vertical and cross sections of the complete apparatus shown, A is the reaction chamber formed by an iron retort built into the regenerator furnace B. It is filled with the "contact material" in the form of perforated iron discs K strung on the central rod R. The retort is provided with an injector C for the introduction of oil and steam, which are supplied to it by the pipe M for the oil, and the pipe L for the steam, which is superheated in the coils N placed in the furnace below the retort. The gas formed escapes, through D and the hydraulic I, to the condensers and purifiers as usual in gas-works.

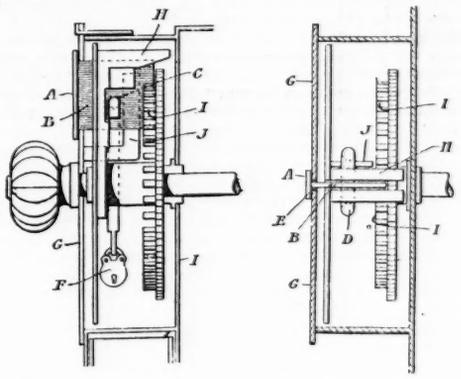
Coin-Freed Gas-Meter Mechanism.—Glover, R. T. & J. G., of Clerkenwell. No. 19,239; Sept. 26, 1901.

This invention relates to means whereby the coin-slot of a coin-freed gas meter can be completely closed, and the passage of gas prevented, when from any cause it is desired to put the meter out of use.

The illustrations show the arrangement as applied to a coin-freed meter of the kind described in patent No. 25,272 of 1894, where a price-changer plate is used adjusted as to position to determine the quantity of gas to be delivered for the coin inserted and hung from a hook to be held in position by a cross-bar fastened to the inside of the casing, while the money-drawer is padlocked.

The means for closing the coin-slot and locking the meter mechanism is a plate A, having an arm or branch B, pierced with holes C for receiving one or more bent pins D or other appliances; the arm being passed through from the outside so as for the outside of the slot E to be covered and be secured to the inside by the pin D. The padlock can then be removed from the money receptacle and hung on to the bent rod D, as at F, or it may be to the branch B of the slot-closer A, and held within the mechanism.

In applying the closer A, the company's seal is broken, and the band or price-changer rod is turned back and the price-changer G and coin-pocket H removed. The slot closer is then inserted in its position—preferably with the arm B engaging the coin-carrier H; and the rod D is inserted through the branch B and placed in such manner that the padlock of the coin receptacle can be secured to it. The price-changer G, with the slot-closer pocket H, are then returned, and the rod and

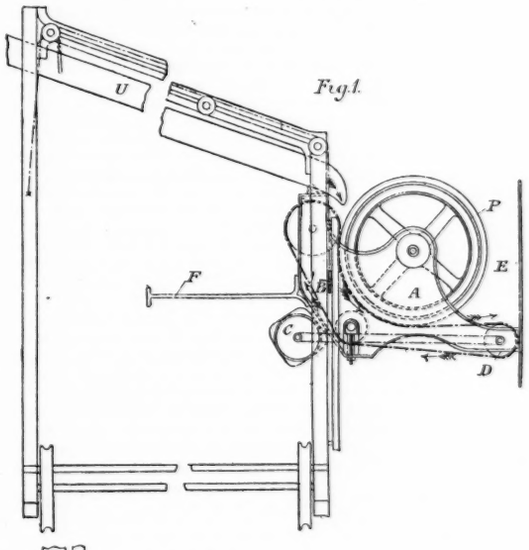


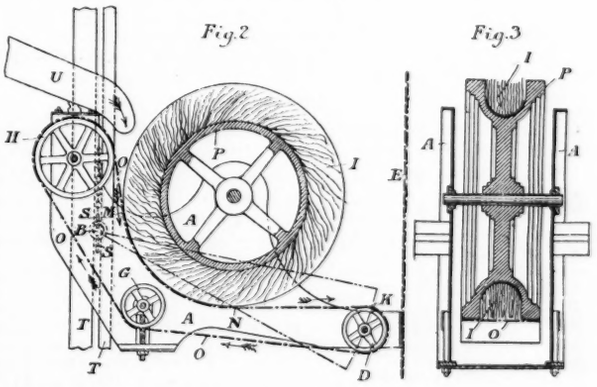
casing locked and sealed; the money-drawer being left open, so that should anyone examine the meter with the object of extracting the money, he will find the till open, and, in consequence, no damage will occur by his forcing open the drawer. Besides, at the same time the meter mechanism is locked as against passage of gas by the arm B engaging one of the teeth of the wheel I, so that no waste or use of gas can occur in that direction. J is the stop for limiting the back-movement of the coin-carrier H.

Charging Gas-Retorts.—De Brouwer, J., of Bruges, Belgium. No. 23,212; Nov. 16, 1901.

This invention relates to the means whereby coal may be projected into retorts "with greater or less velocity according to the position in the retort where the fuel is to be deposited." The problem to be solved, the patentee points out, is to receive granular coal (fine, dry, or wet) and throw it into the retorts, giving to it a speed and a direction determined, without dispersing or crumbling it.

Fig. 1 is a side elevation of the complete apparatus. Figs. 2 and 3 are a longitudinal and transverse section on an enlarged scale of the principal feature of it.





The apparatus mounted in a frame is provided with a motor C. At U is shown a shoot, by which the coal is conducted to the projecting apparatus. The projector A, mounted on a carriage, is suspended at B by chains, which attach it to any kind of appliance capable of being

raised and lowered at will. The inclined plane U for conducting the coal, can also serve to measure it; the coal being led to the projecting apparatus only when the attendant opens an admission valve (this detail is mentioned by the patentee in his specification without being shown in the drawing, simply to avoid confusion; the projecting apparatus, he says, should not conduct the coal).

The movement of the projecting apparatus is a continuous rotary movement; the pulley D giving movement to the whole apparatus. The line E indicates the position of a screen placed between the apparatus and the retort, so as to intercept heat coming from the furnace. This screen has naturally an opening at the place through which the coal projected by the apparatus passes.

The projecting apparatus consists of a frame A, of sheet iron, formed with two parallel faces connected together by transverse plates. The frame takes, in side view, a form similar to that of the body of a small carriage, and serves to support the axles and the bearings of the pulleys. At the point B, situated towards the centre of gravity of the apparatus, the frame is suspended at each side on a trunnion, and, by means of chains, is attached to a winch. The axles or trunnions engage between two uprights, so that the projector is imprisoned laterally.

The trunnions are prolonged on each side in the form of flat plates, which have a certain play between the bars, and they limit, by their contact with the bars, a tipping movement which is given to the frame of the apparatus by means of the lever or handle F. The amount of this movement, which should not exceed a few degrees, as indicated by the dotted lines, serves to modify—raise or lower—the "trajectory of the coal thrown by the projector, in order to go more or less high or more or less far."

On the pulleys D, G, H, is mounted an endless belt O. One of the pulleys G serves to stretch the belt by means of tightening screws. The pulley D receives and transmits the necessary movement to the apparatus. The third pulley H is placed in proximity to the face of the grooved pulley P, without touching it—on the contrary, leaving a space between the point where the belt will leave it and the point M where it will be in contact with the rims or edges of the pulley.

The large pulley P is placed outside the path of the belt, but it modifies this path by depressing the belt between the points M N, distant about a quarter-of-a-circle the one from the other. The pulley presents the following essential characteristics. (*a*) It is hollowed out or grooved a certain depth (having regard to the size of the materials to be projected) in the middle of its face. (*b*) On each side of this hollow or groove, it is formed with a broad rim or side slightly curved, like an ordinary pulley. This hollow or groove forms, in contact with the belt, a chamber closed laterally from the point M to the point N; thus forming a long space bent to an arc of a circle. (*c*) As shown, the hollow or groove of the pulley is provided with a kind of carpet, formed from lisson straps or tongues (say) of fabric, or, better still, of leather, the action of which is as follows: The rotation of the pulley causes these strips or tongues to extend and gives them a certain stiffness. The coal falling into the apparatus comes into contact with the hard walls of the pulley groove and with the belt, and also with these strips or tongues. The contact with the hard walls tends to produce the effects of throwing back the coal; but as against this, the strips yield place to the coal, at the same time offering a certain resistance, which operates to stifle the throwing-back produced, and from that time the effect of the centrifugal force alone will lodge and fix the coal immovably on the belt, which will carry it on towards the point K.

The working of the apparatus is as follows: The attendant starts the apparatus by the lever F. He also opens the admission valve for coal, which will then slide into the shoot U and fall into the hollow or groove of the wheel P. The passage through the chamber formed between the hollow or groove of the wheel P and the belt will be effected instantly by the rapid movement of the latter, and the coal will be projected by its inertia towards and into the retort, while the belt will turn back round the pulley.

The attendant (says the patentee) will follow with his eyes the movement of the coal and the charging of the retort—varying the trajectory of the coal according to requirements, and notably according as to whether the coal should be thrown to the back or only to the front portion of the retort. The same attendant will regulate, if he desires, the movement of the carriage and the regulating of the motor, according to the requirements of the moment, according to the character of the retorts, or according to the quantity of coal that it might be desired to charge into the retort (according to the temperature of this latter).

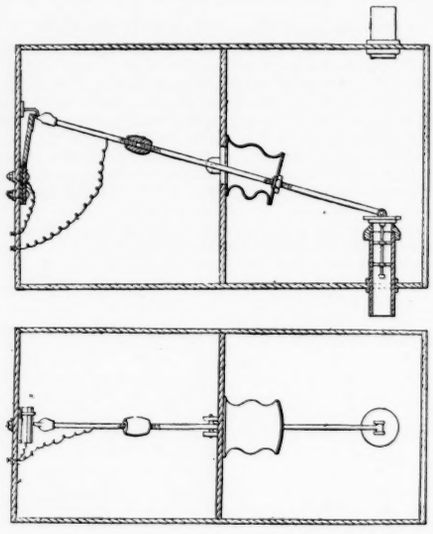
Concluding his specification, M. de Brouwer says: The speed that it will be convenient to give to the projector will vary, naturally, considerably according to the requirements of the work to be done, and, above all, the distance to which the coal should be thrown, although the speed generally should be always rapid—that is to say, according to experience, should attain a lineal speed of about 650 metres per minute in order to charge a retort 3 metres long.

Gas-Escape Indicator.—Medd, G. F., of Twickenham; No. 6007; March 11, 1902.

This gas-escape indicator is a device constructed in such a manner that, in the event of the back-pressure from the house supply-pipe becoming less than the pressure in the pipe leading from the meter (by reason of the gas escaping, or by reason of the gas being burned), an electric bell is sounded.

The case of the instrument is divided by a vertical partition into two compartments, and to the partition a lever is pivoted, which passes through an opening formed in the partition in such a manner that one of the arms projects into each of the compartments; while a small bellows is secured at (say) the right side of the partition, while its opposite closed extremity is secured to the pivoted lever so as to form a flexible casing around the pivotal point of the lever, which allows of gas being admitted to the right-hand compartment without passing to the left-hand one.

Into the former compartment, the gas is led from the meter by a pipe furnished at the top with a rubber cone-shaped cap, which is normally closed by means of a lift valve. An outlet-pipe leads from this compartment to the house supply-pipes. The left arm of the lever is sufficiently weighted to balance the lift-valve, and at its extremity is arranged in close proximity to, but normally out of contact with, a hinged plate affixed to the side of the compartment, but insulated



therefrom by washers. This plate and the weighted extremity of the lever are connected with a bell circuit, so that in the event of the back-pressure of the gas on the lift valve becoming less than the pressure of the gas supplied from the meter, more gas enters the right-hand compartment through the inlet-pipe from the meter, and, in so doing, raises the valve, which causes the lever to turn, bringing its weighted extremity into contact with the hinged plate, and so complete the electric circuit and cause the bell to sound.

APPLICATIONS FOR LETTERS PATENT.

17,192.—Weight, W. H., "Rotary motor to work with a mixture of gas and air." Aug. 5.

17,201.—Arnott, A. A., and The Arnott Light and Burner Company, "Hydrocarbon-burners." Aug. 5.

17,213.—Brookes, A. G., "Purifying blast-furnace gases." A communication from The Deutsch-Luxemburgische Bergwerks-und-Hütten-Aktien-Gesellschaft. Aug. 5.

17,238.—Westenholz, T. F., "Automatically lighting and extinguishing gas-lamps." Aug. 5.

17,265.—Herrick, J. A., "Gas-producers." Aug. 5.

17,297.—Fuchs, F. B. & C., "Gas-generating apparatus." Aug. 6.

17,303.—Bell, L., "Gas-burners." Aug. 6.

17,310.—Baumgarten, H., "Automatic generator and lamp for acetylene gas." Aug. 6.

17,318.—Adam, W. W., "Manufacture of incandescent mantles." Aug. 6.

17,338—Mollart, W., and Turner, C. L., "A fluid composition for application to gas-mantles." Aug. 7.

17,342.—Planet Foundry Company, Ltd., and Ward, T., "Burners for gas cooking-stoves." Aug. 7.

17,343.—Douglas, W. H., "Safety guard to prevent back-lighting in bunsen burners." Aug. 7.

17,360.—O'Brien, J. O., "Apparatus for regulating the pressure of gas." A communication from M. Wagner. Aug. 7.

17,364.—Hartley, A., "A combined coal and gas using kitchener." Aug. 7.

17,400.—Clément, A., "Carburettors." Aug. 7.

17,428.—Turner, E., "Pumps and compressors for liquids, air, and gases." Aug. 8.

17,438.—Smith, F. H., "Explosion engines." Aug. 8.

17,440.—March, E., "Coin or disc freed mechanism." Aug. 8.

17,441.—Caldwell, A., and Cassels, W., "Water-valves." Aug. 8.

17,463.—Dargie, J., "Acetylene gas generators and gasometers." Aug, 8.

17,490.—Burgess, J. L., "The improved king of lights applicable for oil, gas, and electricity." Aug. 8.

17,497.—Hill, T., "Acetylene gas generators and lamps." Aug. 8.

17,526.—Short, S. H., "Starting, reversing, and controlling internal combustion motors." Aug. 8.

17,568.—Ewins, J. A., and Shenton, A. H., "Gas-engines." Aug. 11.

17,576.—Boult, A. J., "Acetylene lamps or generators." A communication from Eugene Moreau. Aug. 11.

17,603.—Bousfield, J. E., "Mantles for incandescence lighting." A communication from Rudolf Finke. Aug. 11.

17,657.—Wield, J., "Coin-freed meters." Aug. 12.

17,764.—Gilmore, J., "Burners for incandescent gas-lamps. Aug. 13.

17,791.—Canellopoulos, J. M., "Automatically lighting gas-burners from a distance." Aug. 13.

17,797.—Ashworth, J. D., "Retorts for the manufacture of gas and other purposes." Aug. 13.

17,806.—Podmore, A. E., and Thomas, J., "Incandescent gas-lamp fittings." Aug. 13.

17,823.—Canellopoulos, J. M., "Catalytic igniters." Aug. 13.

17,832.—Shaw, E., and Gee, E., "Incandescent gas-mantles." Aug. 14.

17,866.—Meyer, E., "Holders for incandescent mantles." Aug. 14.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

A Suggested Rational Metric System.

SIR,—As an advocate of the metric system, I read with much interest the paragraph relating to the above on p. 486; and my object in writing is to point out that the English people are progressing towards its definite adoption.

In the "JOURNAL" for Nov. 1, 1864, it is stated that "the metric system partially sanctioned by Parliament last session has been formally endorsed by the Committee of the British Association, which includes some names of great weight;" and the paragraph judiciously concludes as follows: "To those interested in this very important question, which will not be settled without some more years of argument, we recommend the consideration of the ten resolutions passed by the Committee."

Since the above lines were penned, we have had 38 years of discussion; but, all things considered, I think we are nearer a solution of the problem.

W. B. BRADY.

Aug. 20, 1902.

Mr. Tully's Water-Gas Paper.

SIR,—I notice there is a slight discrepancy between your report and the question which I asked of Mr. Tully at the Irish Association meeting. The question asked was: "Would it be necessary to enrich this gas?"

I consider that the paper by Mr. Tully is of the utmost importance to gas engineers, seeing that Earl Dudley's Bill for the regulation of the supply of water gas will doubtless become law, and that the Board of Trade will probably restrict the carbon monoxide to 20 per cent. Ordinary water-gas plants would suffer greatly if the Bill were passed; but it would be distinctly an advantage to the plant mentioned by Mr. Tully, seeing that his plant would make gas with only 15·03 per cent. of carbon monoxide.

If there would be no need to enrich the gas, I consider the plant would be a most valuable one to gas companies.

J. W. RUSSELL WALL.

Aug. 25, 1902.

The "Acme" Street-Lamp.

The article on the "Acme" street-lamp that appeared in the last issue of the "JOURNAL" was full of appreciation on all points but one, and in regard to that there was a little qualification. It struck us that one of the advantages which the lamp possesses in fine weather would be a little disadvantage when cleaning the burner and cylindrical glass in inclement weather, in comparison with the ordinary form of lantern. In regard to this point, Messrs. A. & E. Cohen, who are putting the lamp on the English market, write: "In your descriptive article, you express the opinion that the fact that, by reason of our special construction the cylinder can be removed, thus exposing the burner and leaving same free to enable the man in charge to blow out the burner, clean the chimney, or renew the mantles, is a disadvantage in a sense, or only an advantage in clement weather. Permit us to point out that in inclement weather there is no reason whatever why our lamps should not be treated in exactly the same manner as a well glass lamp—viz., the cleaner can remove the burner and chimney if he wishes from the top, and clean the cylinder of the lamp without removal, with this great advantage in the case of the Acme that the top of the lamp hinges over in the most convenient manner, and does not need to be removed, as in other street-lamps. There is the further advantage that the glass cylinder of the Acme, being very small in diameter, requires much less cleaning, and consequently there is less time spent in this operation, with reduced risk, than would be the case with a large well glass."

LEGAL INTELLIGENCE.

Illegal Use of Discs to Work Meters.

At the Bath Police Court, on Monday last week, William Turner was summoned by the Bath Gas Company for "fraudulently abstracting, consuming, and using a quantity of gas, to the value of 2d.," between July 16 and August 14. Mr. C. Y. Petgrave prosecuted; defendant, who pleaded "Not guilty," conducted his own case. When the Company's collector called at defendant's house on the latter date, he found that since his previous visit on the 16th of July 1100 cubic feet of gas had been consumed, which would represent pennies to the amount of 4s. On opening the meter, he found therein 3s. 10d. in coppers, a Jubilee commemorative medal, and two bone discs [produced]. He had tested the medal and discs at the gas-works, and found the larger disc and the medal would work a prepayment meter, but the smaller would not. It was the weight and not the size of the article which would set the mechanism in operation. He saw Mrs. Turner at the house; but Mr. Turner was then away. Questioned by defendant, witness said Mrs. Turner did not tell him there were discs in the meter, and offer him 2d. as their equivalent, until he had called her attention to the articles he had found. The defendant, in explanation, said his wife offered the collector the 2d. before he had counted the coppers, and again as he was leaving the house; but he would not accept the money. He went on to say that he and his wife went home about 10.30 one night, and when they tried to light the gas found there was none on. Neither happened to have any change, and the next-door neighbour could not let them have any. In this fix he put one of the discs—the smaller one—into the meter; and it would not answer. Afterwards he put in the larger one and the medal, which worked the meter. He had no intention of defrauding the Company, and objected to the word "fraudulently" which appeared on the summons. They had done the same thing elsewhere. If he had had any intention of defrauding the Company, he could have stated that the children had put the articles in the meter, the position of which would have rendered it impossible to have contradicted him. Mrs. Turner gave evidence to the effect that she had told the collector that there were two pieces of bone and a medal among the coppers before he found it out for himself. When she offered him the 2d. he had opened the meter, but had not looked at the money, which he had in his hand. After a short deliberation, the Bench found defendant guilty of wrongfully obtaining gas from the meter, and fined him 5s. to cover costs; the Chairman (Mr. H. W. Gibbs) remarking that he thought the Company should put their meters in a safer position. Mr. Petgrave said he should like it to be made public that the Company were not prompted by any feeling of animosity against Mr. Turner; but practices such as this would have to be prevented, and the case had been brought forward as a warning.

Death through Inhaling Coal Gas.

At the Coroner's Court, Horseferry Road, Westminster, Mr. J. Troutbeck held an inquiry, on Monday last week, into the circumstances attending the death of Mrs. Letitia Ann Anty, a widow, on the previous Friday. Mr. Luxton (from Messrs. Bedford, Monier-Williams, and Robinson) watched the proceedings on behalf of the Gaslight and Coke Company. From the evidence of Bessie Anty, it appeared that deceased, who was 52 years of age, occupied a kitchen and bedroom at No. 9, West Block, Peabody Buildings. There was a penny-in-the-slot meter and a gas-jet in the kitchen, and also a gas-jet in the bedroom. Deceased had suffered from heart weakness, and had lately been ailing and depressed, but had never threatened to take her own life. There was a fire-place in the bedroom, but it was always blocked up. After deceased was found dead in bed, witness was sent for, and on putting a penny in the slot of the meter found the gas was cut off. Mrs. Margaret Sweetland, a district nurse, said she visited the deceased about half past nine on the evening of the 14th inst., and as she complained of pain, witness advised her to have a doctor; but she declined to do so. On Friday morning, about ten o'clock, witness was fetched by a neighbour, and finding the blinds of Mrs. Anty's room down, and the door locked, she sent for a porter, who obtained access through the front room window, when deceased was found dead in bed—the body being still warm. The window was shut, and there was a strong smell of gas in the room. The jet was full on, and witness turned it off. She did not think deceased had been cooking in the kitchen before going to bed, as she was of abstemious habits. She had known her for twenty years, and had never heard her say she was tired of life, though she had frequently said that if anything happened to her nobody was to trouble. Samuel Burch, the Superintendent of the Peabody Trust Buildings, said he was fetched on the morning in question to deceased's room, and found a strong smell of gas there; but it had been turned off before his arrival. He sent for the collector to see what gas had been consumed, and it was found to have been only two pennyworth in three days. If one pennyworth had been burnt, it would have been necessary to go into the living-room in order to procure a fresh supply. Edgar Gibbins, one of the Company's automatic meter collectors, said he went to the buildings immediately on receipt of the Superintendent's message, and found the gas-tap turned off, and everything correct. The supply of gas, being automatic, was shut off by the meter. All the gas that was paid for had been consumed. He had collected three days previously, and the subsequent consumption amounted to 2d. This was abnormal for three days, as deceased's average during the last four years amounted to 2d. per week. Dr. Collier, who had previously attended deceased, said the cause of death was coal gas poisoning, accelerated by a weak heart. Mr. Luxton having stated that he did not desire to call any witnesses on behalf of the Company, the Coroner summed up the evidence. He pointed out to the Jury that it did not prove conclusively either that the case was one of suicide or of accident. It was quite possible deceased might have left the gas turned on, and forgotten it; or she might have wanted to do a little cooking, and put a penny into the meter before leaving the kitchen, and gone to bed without noticing the smell of gas that was then escaping. The Jury, after consultation, returned a verdict of "Accidental death."

In accordance with the decision of the congress of the Gas Workers and General Labourers' Union held at Manchester during Whitsuntide, a vote of the members has been taken to see whether they are in favour of paying 4d. per annum to a parliamentary representation fund. The members have recorded their votes, with the following results: The number of branches sending in returns was 201, and the number of votes recorded in favour of the formation of a fund was 11,743; while those voting against the proposition numbered 1687. The General Secretary (Mr. Will Thorne) is the parliamentary candidate for South-West Ham, and Mr. Pete Curran, one of the organizers of the Union, is the candidate for Jarrow-on-Tyne.

The "Caterer" has lately published an appreciative little article on the progress of the Richmond Gas Stove and Meter Company, which, the writer says, has been "simply astonishing." "One of the Company's earliest successes," he remarks, "was gained with the popular 'Dragon' fires and the well-known 'Richmond' domestic cookers; but since they turned their attention to planning, designing, and manufacturing kitchen apparatus, and heating, steaming, lighting, and ventilating plant for hotels, restaurants, clubs, and railway dining cars, they have gone ahead in a style that would satisfy even a Carnegie or a Yerkes." A list of well-known hotels, restaurants, public buildings, schools, and residences to which the large types of cooking appliances have been supplied follows; and it is mentioned that the supply of cooking and steaming apparatus complete for the kitchens of Holyrood Palace, Edinburgh, has given so much satisfaction that the Company have been entrusted with the execution of further work there.

MISCELLANEOUS NEWS.

LIVERPOOL UNITED GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Tuesday. In the absence, through illness, of Sir Edward Lawrence, the Chairman, and of the Vice-Chairman (Mr. J. E. Tinne) who was in Ireland, Mr. JAMES LISTER was voted to the chair.

The Directors' report showed that the total revenue during the year ending the 30th of June last was £629,983, and the expenditure £496,864; leaving a surplus of £133,119. After deducting the amount taken for payment of the dividend declared in February and the interest on the debenture stock, there remained a balance of £66,312, out of which the Directors recommended the payment of a dividend for the half year of 5 per cent. on the ordinary consolidated "A" stock and 3½ per cent. on the 7 per cent. "B" stock.

The CHAIRMAN, in moving the adoption of the report, expressed regret that illness prevented the attendance of Sir Edward Lawrence, and then went on to say he thought the proprietors would agree with him that the report presented was the best they had had for many years. The Directors were able to reduce the price of gas supplied after the 30th of June from 2s. 11d. to 2s. 8d. per 1000 cubic feet. He might say that Sir Edward was anxious last year to take off 1d.; but he was rather overruled by the younger and more prudent members of the Board, who preferred to look forward to a reduction of 3d. The consumption of gas, in spite of the electric light, showed an increase for the year of 3 per cent., and since the 30th of June the increase had been 4½ per cent. This proved that electric light, instead of being antagonistic to the Company, was really doing them a great deal of good. People saw a good electric light, and when it was pointed out that the Gas Company could give them quite as good a light if they burned more gas, the result was that they did burn more. There was no pressure in regard to the reduction of 3d. The Directors saw their way to do it easily; and the proprietors might rest assured they were not going too far ahead in that matter.

Mr. MALCOLM GUTHRIE seconded the motion, and it was unanimously adopted.

The dividends recommended were then declared; and the proceedings closed with a vote of thanks to the Chairman for presiding.

Referring to the results of the past year's working, and to the excellent position of the Company, the Manchester "Daily Dispatch" last Wednesday said: "Gas and electricity flourish side by side in Liverpool. They are naturally competitors, and when electricity was introduced into Liverpool, it was expected that gas would sooner or later be extinguished; the competition being enhanced by the fact that the electricity is owned by the Corporation—the people themselves—and the gas by a private Company. Fifty years have passed away since the Corporation first attempted to acquire the gas supply, at which time electricity was not on the market. It has been long enough on the market since then to effect the price of gas, if electricity became a serious competitor. But the effect has been to appreciate the consumption, if not the price, of gas, in Liverpool; and to-day the extraordinary spectacle is presented in that city of a Gas Company more flourishing than ever it was, and of an unexampled demand by the public for electricity as well as gas. Instead of the two lights being enemies, they are allies; how unexpectedly they help instead of opposing each other is seen in the fact that the Gas Company have 1200 lamps attached to the tramway trolley poles in the streets of the city, which, if anywhere, ought to be lighted by electricity, for the Corporation own the trolley poles and the electricity. Still, they find it cheaper to burn gas now themselves, in hundreds of cases, bought from a private Company, than to manufacture electricity for themselves, although the price of the electric light in Liverpool has been enormously reduced from the figure at which it was thought electricity would oust gas. The competition of the electric light has, perhaps, made gas cheaper, but it has also vastly increased its consumption; so that to-day, in Liverpool, if the Corporation wanted to buy the gas undertaking, they would have to pay a much enhanced price on the 49 offers which they are said to have made, more or less, during the last half century, to acquire it."

GAS AND WATER SUPPLY IN LONDON SUBURBS.

The following particulars are taken from the reports of Companies supplying gas and water in London suburbs:—

Barnet.

At the half-yearly general meeting of the Barnet District Gas and Water Company next Friday, the Directors will present accounts showing that the profit on the working in the six months ending the 30th of June amounted to £10,481. After deducting the interest on the mortgage bonds, there remains a net profit of £8874, out of which the Directors recommend the declaration of a dividend, less income-tax, at the rate of 7 per cent. per annum on the "A" and "C" stocks, of 6 per cent. per annum on the "B" stock, and of £4 18s. per cent. per annum on the "D" capital gas and water stocks and shares. These payments will absorb about £7400, and leave some £1470 to be added to the unappropriated balance. In consequence of the more favourable condition of the coal market, the Directors consider they are justified in notifying a reduction in the price of gas from 4s. to 3s. 10d. per 1000 cubic feet as from the 31st of December next. The water portion of the Company's business continues to progress satisfactorily; but, in consequence of the supply of electricity to some of the public lamps and other consumers, the quantity of gas sold during the half year was slightly reduced (about 250,000 cubic feet), compared with the corresponding period of the previous year.

Colney Hatch.

In the six months ending the 30th of June, the Colney Hatch Gas Company sold 40,200,100 cubic feet of gas for public and private lighting—an increase of 9·36 per cent. on the first half of 1901—producing a revenue of £7541. The rental of meters, fittings, and stoves brought this up to £8086, and the total receipts were £9506. The expenditure was £7440; leaving £2066 to go to the profit and loss account. The amount available for distribution is £3786; and the Directors recommend that dividends for the half year at the rates of 10, 7, and 5 per cent. per annum should be declared on the three classes of capital. These will require £2150, and leave £1636 to be carried forward.

Harrow and Stanmore.

At the meeting of the Harrow and Stanmore Gas Company next Monday, the Directors will report continued steady progress in the business of the Company in the six months ending the 30th of June. There was a larger quantity of gas sold, compared with the corresponding half of last year; but there was a falling off in the rental, due to the reduction in the price of gas. The balance of the profit and loss account is £4093; and the Directors recommend dividends at the rates of £8, £7, £5 12s., and £6 per cent. per annum on the original and additional capital and the guaranteed shares of the Company, all less income-tax.

North Middlesex.

At the ordinary half-yearly general meeting of the North Middlesex Gas Company to-morrow the Directors will report an increase of 11·57 per cent. in the quantity of gas consumed in the six months ending the 30th of June, compared with the corresponding period of last year. The increased rental therefrom has more than compensated for the loss caused by the reduction of 3d. per 1000 cubic feet in the price of gas, which took place on July 1, 1901; and the Directors have made a further reduction of 2d. per 1000 feet as from the 1st ult. The revenue in the half year amounted to £12,018, and the expenditure to £9083; leaving £2935 to go to the profit and loss account. After paying interest charges, the amount of profit available for distribution is £4749; and the Directors recommend that dividends for the half year be declared at the rate of 10 per cent. per annum on the original capital, 7 per cent. per annum on the ordinary capital, and 5 per cent. per annum on the preference capital. For the payment of these, the sum of £2454 is required; leaving a balance of £2295 to the credit of the profit and loss account.

PROVINCIAL GAS AND WATER COMPANIES.

GAS COMPANIES.

Altrincham.

The accounts of the Altrincham Gas Company for the six months ending the 30th of June, which will be presented at the ordinary general meeting of the Company to-day, show that for private purposes 78,470,452 cubic feet of gas was sold, yielding a revenue (less discounts) of £10,904. The total receipts were £14,123, and the expenses £9555; leaving a balance of £4568 to be carried to the profit and loss account. The amount available for distribution is £4048, which will provide for the full statutory dividends, and leave a balance of £448 to go forward. The profit realized shows a gain of £1068, compared with the corresponding half of 1901.

Bath.

The accounts to be presented to the shareholders in the Bath Gas Company at their meeting next Friday show that the sale of gas produced a revenue of £31,791 in the six months ending the 30th of June, compared with £33,793 in the corresponding period of 1901; the returns from residuals were £6446, against £8083; and the total receipts were £40,847, compared with £44,201. The expenditure, however, was £31,797, compared with £39,025; the manufacture of gas costing £23,998, against £31,160. The balance carried to the profit and loss account is £9050, whereas this time last year it was only £5176. The sum available for distribution is £11,927; and the Directors recommend the payment of the maximum dividend of 5 per cent. per annum on the consolidated ordinary stock. Reference is made in the report to the retirement of Mr. George Helps from the secretaryship, and the appointment of Mr. H. Shepherd as his successor. Under the supervision of the Engineer and Manager (Mr. C. Stafford Ellery, Assoc. M.Inst.C.E.), a sum of £3784 was expended during the six months on new buildings, machinery, plant, &c., out of a total outlay of £5098 on capital account.

Cheltenham.

The half-yearly report of the Directors of the Cheltenham Gas Company shows that the balance standing to the credit of the profit and loss account allows of the payment of the full statutory dividend at the rate of 5 per cent. per annum upon the paid-up consolidated ordinary stock; and this is recommended. The business of the Company during the past half year was satisfactory, having regard to the mildness of the winter. With the exception of coke, the value of residual products was well maintained. The number of consumers showed the average increase, while the cooking-stoves, known as "The Cheltenham Cooker," continued in constant demand. The new works rendered necessary by the increased consumption of gas have been commenced, and will be steadily proceeded with. The Engineer and Manager (Mr. R. Ormiston Paterson) reported that the works had been maintained in efficient working condition.

Dover.

At the half-yearly general meeting of the Dover Gas Company on the 1st prox., the accounts to be presented will show a net revenue of

£17,134 from the sale of 112,173,300 cubic feet of gas for public and private lighting, of £1719 from the rental of meters and stoves, and of £5103 from the disposal of residual products—making a total of £23,956. On the manufacture of gas, a sum of £14,678 was spent; on distribution, £2089; and on management, £1031—the total expenditure being £19,006; leaving £4950 to go to the profit and loss account. The balance to be carried forward, subject to the half-year's dividends, is £3105; and the Directors recommend the declaration of the usual dividend at the rate of 7½ per cent. per annum, less income-tax. The favourable working in the past six months allows of this, and also of the restoration to the reserve fund of the entire amount (£1244) withdrawn from it a year ago.

Gloucester.

In the report of the Directors of the above Company, to be submitted at the half-yearly meeting next Thursday, the Directors state that the Company continues to make progress, both with regard to the quantity of gas sold and the number of additional consumers. The receipts for residual products diminished in the half year, owing to the decreased price of coke; but tar and sulphate of ammonia improved in value. Coals, however, due to lower prices paid, cost less. The new gasholder is nearly completed, and will be ready in time to assist in the supply of gas during the coming winter. The balance of profit available for distribution is £5606; and the Directors recommend the payment of the statutory dividend at the rate of 5 per cent. per annum upon the consolidated stock of the Company, which will absorb £4356; leaving £1250 to be carried to the next account. The accounts accompanying the report show that the total stock capital paid up is £177,844, and there is £35,000 of loan capital. The manufacture of gas cost £16,097, compared with £18,540 in the corresponding half of last year; and the sale of gas and the meter-rents realized £19,931, against £19,486. The expenses of management were £1388 11s. 8d., compared with £1161.

Normanton.

The half-yearly meeting of the Normanton Gas Company was held on the 16th inst., at the offices, Normanton—Mr. C. Mitchell (Chairman of the Directors) presiding. In moving the adoption of the report and accounts, the Chairman pointed out that the profit for the half year ending June 30 was £1174, which would, however, have been larger had not the profits accruing from the decreased price of coal been consumed by losses on the residuals. Sulphate plant had been erected, which, though so far it had proved satisfactory, had necessitated considerable outlay. The amount available for distribution was £2425; and dividends of 5½ and 4 per cent. on the original and additional stocks respectively were declared.

Portsmouth.

The half-yearly meeting of the Portsea Island Gas Company was held last Saturday—Sir John Baker, J.P., in the chair. The report presented showed that for the six months ending the 30th of June there was an available balance of £38,119, from which the Directors proposed to pay dividends at the rate of 13 per cent. per annum on the "A" and "B" shares, 12 per cent. per annum on the "C" shares, 10 per cent. per annum on the "D" shares, and 5 per cent. on the Company's stock; leaving a balance of £25,426 to be carried forward. The half-year's revenue was £82,521, against an expenditure of £68,734. The quantity of gas manufactured was 521,492,000 cubic feet, against 475,318,000 cubic feet in the corresponding period of last year, and the unaccounted-for gas reduced to 19,599,700 cubic feet, or 4,470,900 cubic feet less than at this time last year. The Chairman, in moving the adoption of the report, said there was little to remark upon, as the progress of the Company had again been of that robust character to which for many years they had been accustomed. The Directors were fortunately removed from all those anxieties and troubles which arose when Boards had unpleasant forebodings as to the future. The Company's progress had been most satisfactory; and the lowering of the quantity of unaccounted-for gas from 5 to a little more than 3 per cent. was a saving due to the zeal of their officials. As to the new works, he said, without reservation, that they had no anxiety pressing upon their attention. It was a stupendous undertaking which their Engineer (Mr. J. D. Ashworth) had in hand; but, with strength of mind and of body, he was rendering excellent service, which they were not slow to recognize. The Vice-Chairman (Sir W. D. King, D.L., J.P.), in seconding the motion, said he had great pleasure in emphasizing the Chairman's remarks. Mr. Oke, of Southampton, observed that he knew of no other similar company in which the quantity of gas unaccounted for was as low as 3 per cent.; and it showed careful watching in every department, under the supervision of a capable Engineer. The motion was carried; a vote of thanks to the Chairman and Directors brought the proceedings to a close.

Ryde.

At the annual general meeting of the Ryde Gas Company last Thursday, the Directors presented accounts which showed that the sale of gas in the twelve months ending the 30th of June produced a revenue of £12,757, while the total receipts were £17,035. The expenditure being £11,828, the balance carried to the profit and loss account was £5207. The amount available for distribution was £2822; and the Directors recommended the declaration of the maximum dividends. At the request of the Corporation, the Company in April undertook for a period of three years the management of the public lighting; and the incandescent system was immediately installed throughout the borough. The steady increase in the consumption of gas continues; and the Company sent out in the past twelve months more stoves than in any previous year. Under the supervision of Mr. F. F. Farrand, the Company's Engineer and Manager, the buildings and plant at the works were well maintained in the period covered by the report, at the close of which the Directors expressed their appreciation of the good work done by the Manager, the Secretary (Mr. A. E. Coombes), and the staff generally.

Scarborough.

Commenting upon the half-yearly report and accounts presented at the recent meeting of the Scarborough Gas Company, as noticed last week, the Chairman (Mr. B. Fowler, J.P.) remarked that, taking the revenue account as a whole, it was the most satisfactory one for a June half year that the Directors had been able to submit for some years. The receipts from the sale of gas showed an increase of £1230 over those for the corresponding half of 1901; but it was necessary to state that about £420 of this was due to the fact that, for the purpose of facilitating the preparation of the accounts, the meter reading in the June quarter of 1901 was completed at an earlier date than was the case in the previous years. The Chairman drew attention to the benefit the Company had derived from working up the ammoniacal liquor into sulphate of ammonia. In the June half of 1901, the sale of liquor amounted to £307; whereas the proceeds from the sulphate in the past six months were £828—an increase of £521. This was extremely satisfactory. The total quantity of gas sold was 124,662,600 cubic feet—being an increase of 8,393,800 cubic feet. The additional revenue was £1544 13s.; whereas the extra expenditure was only £21 13s. 4d. During the half year, the number of consumers had risen by 362, most of them being on the prepayment system. There had been let out on hire 121 additional cooking-stoves; and 63 gas-fires had been sold and fixed. It had also been ascertained that the number of gas-engines used in the town had been augmented by six. A large number of incandescent mantles and burners had been sold during the six months; and he was sure those who had purchased them had received good value in an improved and cheaper light. The report was adopted; and authority was given for the promotion of a Bill next session to enable the Company to raise additional capital not exceeding £75,000. The thanks of the proprietors were accorded to the Chairman and Directors, as well as to the Engineer and Secretary (Mr. Alexander Allan) and the officials of the Company, for their services in the past half year.

Taunton.

The annual general meeting of the Taunton Gas Company was held last Tuesday—Mr. J. Barrett in the chair. The report presented set forth that the quantity of gas sent out during the twelve months covered by it was 78,797,000 cubic feet, and that the amount available for distribution was £3634. Out of this, the Directors recommended the declaration of dividends at the rates of 5 per cent. on the preference stock, 8 per cent. on the "A" stock, and 7 per cent. on the yellow shares and new ordinary stock. The payment of these would amount to £3275, and leave £359 to be carried forward. In moving the adoption of the report, the Chairman remarked that it showed a continual increase in the consumption of gas in the town and district. When he joined the Board in 1875, the consumption of gas was 31,420,900 cubic feet; at the present time it was 78,797,000 cubic feet, which was an increase of 3,998,000 cubic feet on the previous year's working. This he thought was very gratifying, bearing in mind the competition they had had to meet with the electric light. Their dividends had also increased. For the first few years they paid a dividend of 6 per cent. In 1880, one of 7 per cent. was declared. In 1884, an increased dividend of 8 per cent. on the "A" stock and 7 per cent. on the yellow shares was paid; and it had been continued now for the past 18 years. They were continually having applications for the supply of gas, and were about to lay down an increased main for the northern end of the town, in order to meet the demands for gas there. In consequence of this extra business, the Directors would have to issue in a short time the new ordinary stock for which authority was granted at the last annual meeting. The report was adopted, and the dividends recommended were declared. Votes of thanks were accorded to the Chairman and Directors, also to the Secretary and Manager (Mr. A. J. Edwards) and the staff, for their services during the past year; and the proceedings closed.

Wakefield.

In the six months ending the 30th of June, the Wakefield Gas Company had a revenue of £17,134 from the sale of gas for public and private lighting, and a total revenue of £22,624. The expenditure in this period amounting to £16,288, there was a balance of £6336 to go to the profit and loss account. At the meeting on Monday last week, the Directors reported that a sum of £7069 was available for distribution, and they recommended the payment of the following dividends: £11 10s. per cent. per annum on 1000 shares of £25 each, and also on 3660 shares of £5 each; £9 per cent. per annum on 7340 B5ths shares of £5 each; and £8 10s. per cent. per annum on the 5000 new ordinary £10 shares fully paid—the balance to be carried to the next account. In moving the adoption of the accounts, the Chairman (Dr. W. A. Statter, J.P.) said he had a very pleasing duty to perform, as the profit made exceeded by a considerable amount that of any previous half year in the history of the Company, and established a record—in fact, they were able to pay their full dividends, add £222 to the profit and loss account, and write off no less than £2000 from the suspense account, all out of the profits. This brought the suspense account down to £5340; so that if they could continue to reduce it at this rate a little longer it would soon be wiped out altogether. The increase in the quantity of gas sold was 4·18 per cent., which he considered satisfactory. They had now 5844 ordinary meters and 3543 slot meters in use. Carbonizing wages were £968 5s. 9d., compared with £1067 8s. 2d. a year ago, and £1771 17s. 4d. in 1900; so that the inclined retorts had reduced the wages upwards of 45 per cent., which exceeded their expectations, and was extremely gratifying. He next alluded to the maintenance of Welsbach mantles by the Company, which the Directors felt was a step in the right direction, and pointed out that defective burners were generally at the bottom of consumers' complaints. He added that the Company supplied flat-flame burners free on application. The accounts were passed. The shareholders voted the members of the Board an increase in their remuneration from £250 to £500 per annum; but, while thanking them for their generosity, the Board regretted they could not see their way to accept it. A very cordial vote of thanks to the Directors was duly acknowledged by the Chairman, who, in moving the customary vote of thanks to the staff, spoke very highly of the services of the Engineer (Mr. H. Townsend) and the Secretary (Mr. W. H. Parker). These gentlemen having replied, the proceedings terminated.

Watford.

The Directors' report to be presented at the forthcoming half-yearly meeting of the Watford Gas Company sets forth that, during the six months ending the 30th of June, 234 yards of additional main were laid in various parts of the district, and that the number of ordinary and prepayment consumers increased. Fair prices were obtained for residuals. The profits on the half-year's working amounted to £2797. The profit and loss account shows a balance of £3133, and the Directors recommend that dividends for the half year be declared at the rates of 12 per cent, per annum on the "A" stock and 9 per cent. per annum on the "B" and "C" stocks, free of income-tax. A resolution to enable the Directors to raise further capital will be submitted to the proprietors. The constantly increasing consumption of gas has necessitated the provision of additional storage—a new gas-holder, having a capacity of 500,000 cubic feet, being in course of erection—and other plant entailing capital expenditure will be required within a short time.

Weymouth.

At the half-yearly general meeting of the Weymouth Consumers' Gas Company last Thursday, the Directors had to report, for the first time for some years, a diminution in the quantity of gas sold. The decrease occurred during the three winter months, and it was attributable to the mild weather which then prevailed. During the Midsummer quarter there was an increase in the output, which nearly balanced the decrease the preceding quarter. Spread over the half year, however, the reduction in consumption was only slight—being just over 0·5 per cent. Coal cost £728 less than it did a year ago; but nearly half this amount was lost in the returns from coke. The yield from tar and sulphate of ammonia, however, improved. The quantity of gas sold to private consumers was 38,562,800 cubic feet, and it produced a revenue of £7346; a sum of £1753 was obtained from the sale of residuals; and the total receipts were £9376. On the manufacture of gas the sum of £5356 was expended; on distribution, £196; on management, £504; and other items brought up the total to £6738—leaving a balance of £2638 to go to the profit and loss account. The amount available for distribution was £4857; and the Directors recommended the declaration of a dividend for the half year at the rate of 5 per cent. per annum, less income-tax.

WATER COMPANIES.

Brymbo.

The annual general meeting of the Brymbo Water Company was held last Tuesday, at the Imperial Hotel, Wrexham—Sir Theodore Martin, K.C.B., in the chair. The Directors reported an increase of £56 17s. 10d. in the domestic supply, and of £104 18s. 5d. in the trade supply, in the past twelve months, compared with the year 1900-1. The balance from the previous account was £23 5s. 10d.; and the net revenue receipts for the year were £2523 10s. 8d.—making together £2546 16s. 6d. Deducting the interim dividend at the rate of 4 per cent. paid on the 1st of March, and the interest on the debentures, there remained available for distribution £1203 12s. The Directors recommended that a dividend at the rate of 4 per cent. per annum should be declared for the second half year (free of income-tax), and that £263 12s. should be carried forward. The Chairman, in moving the adoption of the report, said it was one which required little or no enlargement from him. The Company had steadily made progress. They had increased the number of the houses supplied, and had made a considerable increase in the trade supply. They had also extended the mains with excellent results. The only new feature was that the Rural District Council outside their area had appealed to the Company to help them in their condition of being without water; and the Directors had arranged to furnish a supply. Considerable outlay had been incurred for extensions to meet the demand for water for trade purposes, and with very satisfactory results. Having alluded to the figures in the accounts, the Chairman put the motion, and it was carried; and the dividend recommended was declared.

Frimley.

At the recent half-yearly general meeting of the Frimley and Farnborough District Water Company, the accounts presented showed that the water-rates in the six months ending June 30 amounted to £4162, and that the total revenue was £4356. As the expenditure was £2433, there was a balance of £1923 to go to the net revenue account. After payment of the interest due upon the debentures, there was, with the balance of £656, a sum of £2363 available for distribution; and the Directors recommended the declaration of a dividend at the rate of 5½ per cent. per annum, carrying forward £744. During the half year 243 houses and 23 meter connections were made under the supervision of the General Manager and Secretary, (Mr. F. W. Talbot) and the mains were extended by 3 miles 935 yards. The Chairman (Mr. A. C. Pain), in moving the adoption of the report, said the receipts in the period covered by it were £4356, against £3285 in the first half of 1901—an increase of nearly £1100—which, he thought, was very satisfactory; and the Directors had recommended an extra 10s. per cent. dividend. The motion was carried unanimously.

South Staffordshire.

At the half-yearly general meeting of the South Staffordshire Water Company on Thursday, the Directors will report that the number of houses laid on during the six months ending the 30th of June was 1789; making the total number supplied 114,573. The gross amount of water-rates was £58,104, against £55,418 in the corresponding period of 1901. After providing for interest on the debenture and preference stock, the amount remaining for division (including £6762 brought forward) is £24,537; and the Directors will recommend the declaration of a dividend on the ordinary stock at the rate of 6 per cent. per annum, free of income-tax. The amount of this dividend being £17,850, there will remain £6687 to the credit of the next half year. The report of the Engineer (Mr. H. Ashton Hill, M.Inst.C.E.) as to the condition of the Company's works and plant sets forth that they are in substantial order and repair.

GLASGOW CORPORATION GAS UNDERTAKING.

The Accounts before the Corporation—The Coal Contracts.

The annual report of the Glasgow Corporation Gas Committee, and the accounts of the Department for the year ending May 31, which were noticed in the "JOURNAL" last week, were submitted at a meeting of the Corporation on Thursday.

Mr. R. M. MITCHELL, the Convener of the Committee, in moving the adoption of the report and accounts, said it was satisfactory to have to report that the consumption of gas was still increasing, having exceeded last year by 4 per cent. While they had not succeeded in entirely wiping out the debit balance of the previous year, they thought that, in reducing it by £39,000, they had done well; leaving a balance of £15,000 to be carried to the debit of this year's account. Notwithstanding the debit balance, considering the prospects for the year's working, the price of coal contracted for, and the products, the Committee felt justified in recommending the Corporation to reduce the price of gas 2d. per 1000 cubic feet from the date of the last survey. It would be observed from the report that it was proposed to make a new departure from former practice by giving a supply of gas for motive power purposes at 4d. per 1000 cubic feet less than the price charged for the time being for gas supplied for lighting purposes—the gas to be registered by separate meter. In making this proposal, he should like to say that at present a revenue of about £30,000 per annum was obtained from gas supplied for motive-power purposes. A number of their customers had felt that, unless a reduction were made, they might require to provide gas-producer plant of their own, which would give them a supply of suitable gas at a very much lower cost. Their Engineer (Mr. W. Foulis) informed them that, with their quality of gas at 2s. per 1000 cubic feet, it would probably be the means of retaining their custom, and preventing them from incurring the outlay necessary to provide such gas-producing plant. This arrangement, if successful, would give them an increased demand, which would enable them to employ their plant during the whole day, summer and winter, thus cheapening the cost of production; and when the new works at Provan were completed, as anticipated, within the next twelve months, it would entirely prevent any difficulty of overtaking whatever extra demand might be made upon the department during the winter months. In regard to the proposed unification of debt scheme, the Council would bear in mind that the value of the annuity stock would be augmented by £688,750; thus increasing the capital account to £2,413,750, which was really the liability of the gas undertaking. No doubt were the gas-works a private undertaking, even that amount of capital would be unusually moderate. But it must not be forgotten that the Gas Department was established to supply gas at the lowest possible rate to the citizens; and that while it was their duty to give as cheap a supply as possible to their present consumers, they must conduct the department on something like sound business principles, as there was no prospect whatever of their splendid works ceasing to be one of the great municipal enterprises of which they were so proud. It would be observed from the minutes that the arrangements for supplying Milngavie came into force on the 31st of July, and that the Committee had fixed the price at 3s. 4d. per 1000 cubic feet, which would be a new and profitable outlet, and in time would no doubt become a large and increasing area of supply, and might tend to further extension of the city boundaries at no distant date. At the new show-room in Union Street, the latest lighting, heating, and cooking appliances by gas might be seen. They would like the citizens to make themselves thoroughly acquainted with the economy and brilliancy of incandescent lighting, and the great advantage to be gained, especially in small houses, by the use of gas heating and cooking apparatus. The Committee had to express their thanks to the officials for their continuous excellent services; and they looked forward to the pleasure of inviting the Corporation to the inauguration of the Provan works, which they believed to be the most modernly-equipped and economical works which had yet been erected.

Mr. FIFE, in seconding the motion, said it must be very gratifying to the Council that the Committee had faced the important question of depreciation at a critical time like the present, and that last year they had written off £32,000. Moreover, they had now only £15,000 of a debit balance to write off; and this they hoped to do in the current year, more especially as they had made a more favourable arrangement for coal contracts during the next twelve months. With regard to the sliding-scale charge for users of gas for motive power, he said there might be difference of opinion among members of the Council as to whether that scale should not be extended to those who used gas for cooking, heating, or other purposes, as well as for motive power; but he reminded them that they were only making a beginning with that very important scheme. There were something like 17,000 or 18,000 engines of larger or smaller power in use in the city; and the Committee had reason to believe that, if special facilities were granted for the cheapening of gas, more engines would be brought into use.

Mr. G. MITCHELL moved, as an amendment, that the subject of the proposed differential rate should be remitted back to the Committee for further consideration.

Mr. W. F. ANDERSON seconded the amendment. He said the proposal to establish a differential rate was in violation of a principle which had been held by the Corporation for many years. The Committee proposed that the commercial consumer, who paid 2s. 2d. per 1000 cubic feet for his gas, and charged his profit on this amount, should be able to get his gas 4d. per 1000 cubic feet cheaper than the man who was compelled to use gas as a necessity. If they were going to reduce the price for motive power, the reduction should be made general.

Bailie FINLAY supported the amendment; characterizing the proposal as one of the most foolish that had come before the Council for a long time. In 1876, the Council resolved to depart from the differential rate in giving a discount; and the present was a retrograde step to propose.

Mr. BILSLAND expressed the opinion that the Gas Committee

deserved credit for having made the proposal. If gas-engines and electric motors were more generally used, they would have a purer atmosphere.

Mr. FORSYTH supported the amendment. As a member of the Smoke Committee, he desired to see the atmosphere purified; and he considered they ought to hold out inducements to people to use gas-stoves. He believed that in this way they would have a purer atmosphere than by reducing the charge for gas-engines.

After some further discussion, the minutes of the Committee were adopted by a large majority.

At the same meeting, Mr. Scott Gibson remarked that the Committee had fixed coal contracts to the amount of 569,000 tons, and that the contracts extended over twelve months. He thought it would have been better, in view of the possibility of a fall, that they should only have been for six months. Bailie Calderwood pointed out that the custom had been to fix the contracts for twelve months, as the Committee had been under the impression that six months' contracts would put them in serious difficulty. Mr. Gibson said he could not accept the statement. He could see no difficulty in making a contract for six months, and he moved that this minute be taken back. Bailie Ferguson seconded the motion. He did not see why, in the face of a falling market, they should accept a contract for twelve months. Bailie Finlay supported the proposal of the Committee, who, he contended, were justified in acting under the guidance of gentlemen who had had many years' experience of buying coal. Bailie Willock maintained that the method of purchasing adopted by the Corporation was the only one for such an undertaking as the Glasgow Gas-Works. Mr. Bruce Murray said he was convinced that any departure from the principle of contracting for a year at a time would be a mistake. On a vote being taken, only two members supported the amendment.

GOOLE GAS AND WATER SUPPLY.

A Profitable Year's Working—Mr. Dunn's Resignation.

At the Meeting of the Gas and Water Committee of the Goole District Council on Monday last week, the working of the Gas and Water Department for the year ending March 31 was under consideration.

Mr. JACKSON said he understood that at the last meeting a Committee was nominated for the purpose of considering the balance-sheet. He should like to know how it was that at this stage a Committee of that description had been appointed, because he had a balance-sheet put into his hands some eight or nine weeks since, and he understood then that a Committee was to go into the figures and report to a meeting prior to the adoption of the balance-sheet by a full Gas and Water Committee meeting. He had been away from Goole, and during his absence a statement had appeared to the effect that there had been a loss of £1000 on the year's working at the gas-works. If such a condition of things really existed—which he contended did not, from figures he had been able to get from the balance-sheet—it was a reflection upon the Committee that such a statement should have been allowed to go before the public without some remark being made upon the accounts.

The CLERK (Mr. J. W. Johnson) said rough balance-sheets were prepared and laid before every member of the Committee. Certain items were gone through, and then it was decided to defer the matter. With regard to the newspaper report, Mr. Jackson might take it that nothing official had gone from the office. The Committee was appointed on the 21st of July, with instructions to bring before the Council a statement showing the financial position of the Gas and Water Department, and also to prepare a scheme to put the concern on a sound financial footing; but they had not had an opportunity of meeting.

Mr. JACKSON said he considered it wrong, both to the Committee and the Manager, that such an incorrect statement should have gone forth. It had been circulated far and wide that the Committee had sustained a loss of over £1000, and he was here to repudiate the statement. He was sorry their Chairman was not present; but, in his absence, he repudiated it; and the sooner a true statement was given to the ratepayers the better, because they were justly entitled to it.

Mr. GOODERIDGE endorsed what the previous speaker had said. He thought the statement should be contradicted.

The CLERK: The report is altogether premature and unofficial.

Mr. JACKSON said, from what he had been able to gather from the balance-sheet, the profits were better this year than they had been since the Council had had possession of the gas and water works. He had sufficient figures to prove this to be the case, and he hoped the ratepayers would not have to wait another six months before they knew the true state of affairs. They should not have been given a balance-sheet that had not been finally brought before the Committee in its amended state.

After some further discussion, it was resolved to ask the Sub Committee to present their report at the next meeting of the Gas and Water Committee.

Mr. MATT. DUNN (the Engineer and Manager) then presented his working statement in regard to the gas undertaking. It showed that the quantity of coal carbonized in the past financial year was 5631 tons 11 cwt., which cost £4412 17s. 9d., compared with 5413 tons 16 cwt., costing £4251 4s. 5d., in 1900-1; being at the respective rates of 15s. 8·06d., and 17s. 6·62d. per ton respectively—a decrease of 1s. 10·56d. per ton. The quantity of gas made was 60,615,000 cubic feet, against 58,223,000 cubic feet; being 2,392,000 cubic feet, or 9·46 per cent. increase in the make per ton. The quantity accounted for was 94·6 per cent. of the make, against 94·4 per cent. in 1900-1. The sales to private consumers were about 2½ millions in excess of the preceding year. There was consequently an increase of £374 in the gas-rental—£9063 against £8689. The returns from coke and tar fell off; but sulphate was better to the extent of £79. Mr. Dunn explained that the decreased revenue from residuals was due to a reduction in price. In the case of coke this was pretty general. All things considered, however, they had maintained a fair price; but the reduction of £753 11s. 4d. was equivalent to almost 3s. per ton of coal carbonized. They had also sold more tar; but the total realized was £111 12s. 9d. less. The reason for this was that in 1900-1 they were getting 29s. per ton, while last year they were only getting 20s. 6d. per ton. With regard to ammoniacal liquour, they had altered their system of pumps, and by putting them into full operation, and working them for all they were worth, there was an increase in the returns of £79 odd. He thought the record for the year 1901-2 was far ahead of anything previously shown.

Mr. JACKSON moved the adoption of the statement, and it was carried.

The figures in regard to the working of the water undertaking were next submitted and passed. The quantity of water pumped last year was 158,447,808 gallons, against 158,359,437 gallons in 1900-1; the average daily consumption per head being 24·8 gallons. The cost of coal was £579 7s. 6d., against £575 13s. 1d.; working out to 0·872d. and 0·873d. per 1000 gallons of water pumped. The water-rental was £2814 9s. 6d.; being an increase of £17 18s. 4d. on the year 1900-1.

The CLERK then announced Mr. Dunn's resignation, and his desire to be relieved of his duties in October.

Mr. GOODERIDGE moved that the resignation be accepted He expressed his personal regret at parting with Mr. Dunn, who, during the time he had been with them, had, he said, done his best; and he (the speaker) hoped that in his next place he would have the same advantages as he had had at Goole. The Council had done everything they possibly could for him; and, as the result, they had brought their gas-works up to date. Their next Gas Manager would consequently have a straight course before him.

Mr. GRAYBURN seconded the motion; saying they all regretted that that were losing Mr. Dunn. He had given them the very utmost satisfaction during the time he had been their Gas Manager. He had always been full of information for them, on all occasions most definite and accurate, when they had asked for it; and he did not know anything that was more satisfactory in an officer of his position than this quality.

Mr. JACKSON endorsed the remarks of the previous speakers. He said he believed that, since he had been with them, Mr. Dunn had had the interests of his department at heart; and anyone who would go and examine the gas-works would find them to be in a very efficient state.

The Committee accepted the resignation.

PUBLIC LIGHTING OF EAST COWES.

Gas Triumphs Over Electricity.

The East Cowes District Council have lately been considering the subject of the relative suitability and cheapness of electricity and gas for the public lighting of the borough. The Isle of Wight Electric Light and Power Company submitted a tender offering to alter all the existing lamps for their illuminant, and supply 25-candle power lights, with six lights of 50-candle power at important crossings, at £2 10s. per lamp, on a contract for five years. Of course, with the view of ensuring them success, they made all kinds of disparaging remarks in regard to the incandescent system which their competitors, the Gas Company, proposed to employ. But they met with more than their match in the Engineer and Lessee of the gas-works, Mr. Robert Fish, who, in a letter addressed to each member of the Council, as well as to the "Isle of Wight County Press," very clearly set forth the unmistakable advantages of that system as proved by the preference shown for it in a number of important towns. He pointed out that the Council need not travel far for proof of its excellence. Let them go to Ryde and judge of its capabilities, and then compare the light given there with what the inhabitants of Sandown and Shanklin are getting from so-called 30-candle power glow lamps. He showed that whereas the radiating power of the lamps at Shanklin seldom exceeded 25 yards, that of a "C" incandescent burner in use is not less than 55 yards—a very wide difference. Mr. Fish asked the Council, as reasonable men, to consider if there was a general feeling of dissatisfaction with electric lighting within a short period after its installation, what it was likely to be at the end of seven and even three years contracts. In the matter of quality of light he could beat his opponents; but in price they beat him to the extent of 2s. per lamp! But he was careful to point out that against this small difference, amounting to only £34 during the five years contract, there must be put the superior candle power offered by the Gas Company—viz., 35-candle power more per lamp—the painting of all the columns and brackets, and the munificent offer to hand over to the Council at the end of five years, free of charge, the whole of the new lanterns, governors, and burners employed in the installation, costing more than £100. He thus proved beyond question that his tender was by far the most advantageous to the Council and ratepayers. He was amply rewarded for his trouble; for, at a special meeting held last Tuesday, it was unanimously resolved to accept his offer. He has thus achieved a double victory—he has secured a contract for five years and a triumph for gas.

Damage to a Water-Main by Gas Workmen.—Considerable excitement was caused on Monday afternoon last week, at the end of Framwellgate Bridge, Durham, where for about a quarter-of-an-hour there was an unusual aquatic display. Some workmen had opened the street opposite a tobacconist's shop, with the object of finding the gas-main, when one of them accidentally caught with his pick a large tap on the water-main, and pulled it off. Instantly there was an outburst of water which shot in a large volume fully 50 feet into the air; while a strong side jet entered the shop and completely deluged it. Stones and soil were promptly thrown upon the opening, and were as promptly expelled by the force of water. It was not till a large sack had been filled and placed over the aperture that the outburst was brought under control.

PUBLIC LIGHTING QUESTION AT PLYMOUTH.

The recent report of the Electrical Engineer of Plymouth on the cost of public lighting under the old and new conditions (*ante*, p. 162) is subjected to sharp criticism by a correspondent of one of the local newspapers. In the first place, it is pointed out that, in making out the account of the cost under the old conditions, the quantity of gas consumed is said to be unknown; and yet the total candle power is put down at 32,746, and the cost per candle power at 4s. 5d. If the quantity of gas consumed is not known, how, asks the correspondent, are the other figures arrived at? Then with regard to the electric arc lights, it is remarked that these cost last year £248 more than the estimate, and that the total cost of £1224 works out to an average of £21 2s. per lamp, which is characterized as "a very stiff price to pay," seeing that these lamps are lit very late, half put out at midnight, and the other half put out very early in the morning. On the other hand, the incandescent gas-lamps cost £267 less than the estimate. They are "lit early in the afternoon, are not put out until daylight is well assured, give a very decent light, and only cost £1 2s. and a fraction per lamp per annum." The correspondent points out that a number of the charges are grouped, and that it is impossible to tell what proportion of the cost of labour and maintenance, painting, posts, and salaries goes to the gas, and what to the electricity accounts. "I suppose," he adds, "while the gas lighting is under the Electrical Engineer, we can hardly expect any very lucid analysis. It might show up the immense cost of the electricity as compared with gas. . . I fear at present we, although charging a big price for electric current, are supplementing a deficit by an extra charge on gas. Anyway, a more amplified statement of accounts, with individual charges to each illuminant, would be far better and much more satisfactory." The probability is that this fuller statement will not be forthcoming. A Town Council which has muddled into such a condition of financial embarrassment as that of Plymouth is not likely to trouble very much about a trifle like this of whether electric lighting is costing two or three or ten times more than gas lighting would cost. In addition to any difficulty on this score, there is also a powerful inducement to leave things alone in the fact that if it were to deprive the electricity works of the street lighting revenue, it would reduce that struggling undertaking to a position of absolute bankruptcy.

MUNICIPALIZED GAS-WORKS IN ITALY.

Up to the present time, the information which has reached England in regard to the gas undertakings in the hands of municipalities in Italy has been rather scanty; and therefore it may be of interest to give the following particulars, which recently appeared in "Elettricità." They were furnished by Signor Fumero, an engineer, who obtained them from a Government return; and they are given in the order of importance of the towns.

Bologna.—The capital engaged in the large works in this city is estimated at more than 6,600,000 lire (or £264,000), 25 lire being equal roughly to £1 sterling. The annual receipts are about 2,000,000 lire (£80,000); and there is a net profit of a little more than 100,000 lire (£4000). Before municipalization, the gas for street lighting cost 22c. per cubic metre, or about 5s. per 1000 cubic feet, and 11c. afterwards. Private consumers pay the same rates now as before—viz., 25c. per cubic metre (5s. 7½d. per 1000 cubic feet) when the gas is employed solely for lighting purposes, 23c. when it is used for heating, and 24c. when used for both lighting and heating. For motive power the rates have been reduced from 23c. to 20c. The works were acquired by the Municipality on payment of a sum equal to the certified capital of the selling Company, *plus* a capitalized compensation for the estimated profits during the unexpired term of their concession. The purchase-money was raised by a loan at from 4½ to 5 per cent. In this transaction, the principle of respecting equally the rights of the vendors and those of the public was applied.

Padua.—The works in this city were municipalized in 1896—the concession expiring in that year—on payment of 380,000 lire (£15,200), which was their certified value. As the Municipality had also to pay the profits of the vendors from August, 1896, to Sept. 30, 1897, the total indemnity amounted to 650,000 lire, which was paid in two equal instalments in January 1897 and 1898. The sum of 270,000 lire was realized as profits from the undertaking. Extensions being contemplated to the amount of 589,000 lire, 100,000 lire per annum was assigned for the purpose. This work is now almost finished. The requisite funds to complete the purchase were raised by borrowing from the local bank at a rate of interest which was one-eighth less than that required by the Bank of Italy. The loan is to be paid off out of the profits, another ten years being necessary to do this. Before municipalization of the works, the gas cost 16·46c. per cubic metre (3s. 8d. per 1000 cubic feet) for public lighting; 17·28c. for lighting the municipal buildings and for extraordinary purposes; 36c. for charitable institutions, and 38c for private consumption. The cost for street lighting is now the bare cost of manufacture—viz., 9c. per cubic metre (2s. per 1000 cubic feet); and the commune consequently saves 35,000 lire per annum which was previously paid for the service. Private consumers pay 20c. (4s. 6d.) for heating and lighting, and 18c. for motive power. Since 1899, the works have been in the hands of a Manager who is responsible to the Council, and the accounts are kept separate. The annual receipts in round figures, are 845,000 lire, and the expenses 776,500 lire. The interest and sinking fund payments come to a little more than 68,000 lire,

Leghorn.—The value of these works was about 360,000 lire, and the estimated receipts are 194,600 lire, in round figures. Before their municipalization, the price of gas to private consumers was from 20c. to 28c. per cubic metre, according to quantity, for lighting purposes, 22c. for heating, and from 20c. to 21c. for motive power. The Municipality paid 16c. When the works were transferred, private consumers only paid from 19c. to 26c. for lighting, 20c. for heating, and 18c. to 20c. for engines. The purchase-money is to be paid in five annual instalments, one of which has been handed over.

Vicenza.—The works in this town, which were purchased from a private Company, yield annual profits to the amount of 4300 lire, besides effecting an economy of 12,000 lire in the cost of street lighting. Their actual value is 487,000 lire, and the annual income is not far short of 300,000 lire. Before municipalization, the cost for street lighting was 25c., for private lighting (including tax) 40c., for industrial purposes 20c. per cubic metre. Now the prices are 24c. for street lighting, 27c. for private consumption, and 20c. for industrial purposes.

Voghera.—Originally the cost of gas in this town was 40c. per cubic metre; then for the last two years it was 25c., and now it is 13c. The plant was municipalized in 1899, when the electric light works were established; being purchased by means of a loan of 400,000 lire from the local bank. The actual value is estimated at 453,000 lire. The receipts are 306,000 lire, and expenses rather less than 273,000 lire, including the cost of new plant and certain expenses of a patrimonial character. There has been a deficit of 33,000 lire during the past two years, which has burdened the gas undertaking, though the initial cause was mainly the installation of the electric plant.

Spezia.—These works are valued at 450,000 lire. The receipts are 227,000 lire, and the expenses 231,000 lire per annum, *plus* the redemption of capital. In the receipts, the price of gas used for street lighting and that of the coke and gas for heating and lighting charitable institutions and public buildings are not included. No particulars are given as to the price of gas for private consumption.

Udine.—In this town there are small works valued at 270,000 lire. The annual receipts are 14,000 lire. Before municipalization, the gas cost 32c. per cubic metre; whereas now it is 27c. for lighting, 18c. for heating and industrial purposes, 22c. for mixed uses, and when the monthly consumption is at least 22 cubic metres (about 800 cubic feet).

Asti.—The particulars in this case are very dubious. The value assigned to the works is 214,000 lire; but the sum paid for them on municipalization was 28,800 lire. The price of gas was reduced from 25c. to 16c. per cubic metre for industrial uses and to 20c. for other purposes. The consumption for street lighting is 231,000 cubic metres, which at the assumed cost of 12c. per cubic metre for manufacture would give a profit of 42,000 lire, including the 25,000 lire paid by private consumers. Out of this sum, interest has to be paid upon a loan.

Reggia Calabria.—These works, which were municipalized in 1897, are valued at about 189,000 lire. The annual receipts are 83,000 lire from private lighting and 57,000 lire from the public lamps. The expenses are perfectly balanced, so that gas is supplied at cost price. The actual charge for gas is 28c. per cubic metre for lighting, *plus* the tax, and 23c. for industrial purposes. Previously they paid 48c. and 30c. respectively.

Ascoli Piceno.—These works were acquired by means of a loan, and they are valued at rather more than 100,000 lire. The receipts are 95,500 lire, including the public lighting, the expenses, including 5000 lire for interest and sinking fund in respect of a loan, are 46,000 lire. Before municipalization, the price of gas was 45c. per cubic metre; whereas it is now 30c.

GLASGOW CORPORATION ELECTRICITY SUPPLY.

The Accounts for the Past Year.

The annual accounts of the Glasgow Corporation Electricity Department show that for the year ending the 31st of May last the gross revenue amounted to £103,940, and the working expenditure to £51,442, leaving a balance of £52,498, out of which the following payments have had to be met: (1) Interest on loans £29,416, and sinking fund £8567. There is therefore left a balance of £14,514 on the year's ordinary working. From this is deducted £3084, as the proportion charged to the year's revenue of the cost of lamps and fittings consequent on change of voltage; leaving the surplus on the year's operations £11,430. The Committee state that they had given serious consideration to the question of the disposal of the surplus, and had come to the conclusion that, as it was insufficient to provide for a general depreciation of the whole capital of the undertaking, as certain plant and buildings had been disposed of at a price less than the nominal book value, and as a considerable quantity of plant had been, or shortly would be, thrown out of use at the Waterloo Street and Kelvinside Stations, owing to the change of pressure from 100 to 250 volts (which plant will probably not realize its full book value), the wisest and most prudent course to follow was to apply the money to the reduction of the capital accounts involved. They accordingly recommended a scheme of apportionment among six different accounts of sums ranging from £80 to £6434. They noted with pleasure the increasing return on the capital of the undertaking; but as the surplus for the year was a moderate one, and as the contribution to the sinking fund, at the increased rate of 2½ per cent. upon the amount borrowed, would begin with the year 1902-3, they did not recommend any alteration in the rates of charge for electricity to be supplied during the current year.

The quantity of electricity sold to private consumers during the year was 8,384,696 units, compared with 6,290,819 units in the preceding year—an increase equal to 33·28 per cent. The sales were: 2,155,736 units at 6d. per unit, 85,580 units at 4d., 920,647 units at 3½d., 54,193 units at 3d., 808,348 units at 2d., 1,389,540 units at 1½d., and 2,970,652 units at 1d. An analysis of the consumers' accounts shows that there were 983 consumers of less than 100 units each, the total quantity consumed by them being 40,219 units; 1617 of less than 500 units each, taking 374,700 units; 982 of less than 1000 units each, 710,110 units; 809 of less than 2000 units each, 1,173,641 units; 331 of less than 3000 units each, 818,491 units; 205 of less than 4000 units each, 703,051 units; 106 of less than 5000 units, 469,269 units each; 147 of less than 7500 units each, 892,861 units: 53 of less than 10,000 units each, 468,824 units; 72 of less than 15,000 units each, 881,363 units; 22 of less than 20,000 units each, 426,780 units; 38 of less than 30,000 units each,

1,004,080 units; and 11 of more than 30,000 units each, 421,307 units. The number of consumers on the 31st of May was 5374, compared with 4031 a year before—an increase of 1343, or equal to 33·31 per cent. during the year. The number of motors in use and supplied off the Corporation mains at the close of the financial year was 682, with a total of 3086-horse power, compared with 427, with a total of 1894-horse power a year ago.

The total number of arc lamps erected and in regular use in the streets at the 31st of May was 500, compared with 348 a year before; and the quantity of electricity consumed for street and stair lighting was 897,347 units, compared with 523,172 units during the preceding year. The number of 8-candle lamps applied for, or the equivalent in other devices, was 491,306, compared with 368,342—an increase of 122,964.

The maximum load occurred on the 8th of November, when it was 7950 kilowatts. The total available indicated horse power in working order is 19,900, though so much of it as is in the Waterloo Street station (2320 indicated horse power) is being gradually thrown out of use as the result of change of pressure and the connecting of old consumers on to the supplies from the new stations. The Committee have at present under consideration the question of utilizing gas-engines, possibly in conjunction with gas-producers, for further extensions of plant, which will probably be necessary in a year or two.

The Committee add that a new measure which will be of considerable importance to the Electricity Department has been introduced into Parliament by Lord Balfour of Burleigh (the Secretary for Scotland) to amend the borrowing provisions of the Electric Lighting Act, 1882, and the Electric Lighting (Scotland) Act, 1890, section 1 of which provides that the amount which a local authority within the meaning of the schedule to the latter Act may borrow, under section 8 of the Act of 1882, shall not be subject to any limit imposed on the amount which such local authority may borrow for the purposes of their gas undertaking, with provisions as to repayment within forty years, or a shorter period if prescribed; but the Act is not to affect any loan raised before its passing.

The capital account of the department amounts to £1,017,000, of which £980,231 has been borrowed, and £36,769 repaid. The capital expenditure during the year amounted to £138,011. The revenue account shows that £97,050 was derived from the sale of current by meter, and £6890 from public lighting. The generation of electricity entailed an expenditure of £28,112, of which coal cost £13,550, and wages came to £6871. Distribution cost £8333. Rates, rents, and taxes amounted to £5978; and management cost £6210.

The total quantity of electricity generated was 11,122,606 units, of which 8,384,696 units were sold to private consumers, 884,839 were consumed in public lamps, 12,508 were supplied by contract, and 829,713 were used on the works. The total accounted for was 10,111,756 units; leaving 1,010,850 units, or equal to 9 per cent., lost in distribution or otherwise. The average price received was 2·78d. per unit, compared with 2·81d. in the previous year, and 3·51d. in the year ending May 31, 1900.

The accounts were submitted at a meeting of the Corporation last Thursday by Bailie W. Maclay, the Convener of the Committee, who, in moving their adoption, pointed out that at the end of the financial year they found themselves with an increased revenue of something like £35,000; and, after satisfying every demand which could be made upon them under their Provisional Order, they had a surplus of £14,514. From this there fell to be deducted an item in the suspense account of £3083; in other words, there was a net surplus of £11,430, every penny of which they recommended should be set aside for depreciation. In 1900-1, the gross revenue amounted to £79,449, gained at a gross expenditure of £50,000. Last year the revenue went up to £103,940, which was secured at a small increase in the expenditure. If they went on at the same rate, he hoped they would be able to make a better appearance in the future. Bailie Finlay seconded the motion, and it was carried.

ELECTRIC LIGHTING NOTES.

Protecting Gas and Water Pipes.

For the protection of gas and water pipes against straying electric currents, the Baltimore Tramways Company are to lay a heavy copper wire through the pipe subways. It is expected that the wire will take up the escaping current from the tramway system. If it does this, it will, according to report, afford considerable relief to the gas and water suppliers.

Electric Cables on Fire.

There was an extraordinary scene in Drury Lane on Monday morning last week. About 10.30 there was a loud explosion, a stretch of the pavement for 15 feet in one direction was blown up, and a big body of flame began to rise from the hole. It was soon apparent that the cables of the Charing Cross and Strand Electricity Supply Corporation and of the Metropolitan Electric Supply Company, Limited, were on fire, and that the fire had been preceded by an explosion which had seriously affected two shops. The flames were extinguished in the course of half-an-hour. The official report of the occurrence describes the cause as "unknown."

A Scare at Exeter.

With the perversity which is so often remarked, the electric light in a considerable portion of Exeter suddenly went out on Thursday night. The time was singularly unpropitious for a mishap of this kind, for the city was doing its best to entertain the Royal Institute of Public Health. There was a large crowd on Northenhay, where a band was performing, and also a crowded audience at the theatre, when the light failed. The music of the band came to a sudden stop; while at the theatre the performance (it was Shakespeare's "Taming of the Shrew," by Mr. Benson's company) was continued with such imperfect illumination as the limelight afforded. Fortunately gas is laid on in the auditorium; so that the spectators were not under any alarm. Outside the theatre the incident gave rise to a great sensation. For some reason the Fire Brigade was summoned when the electric light went out, and people who saw the firemen hurrying to the theatre concluded that the building was on fire. The memory of the dreadful accident which occurred at the theatre some twenty years ago is still keen in Exeter, and the excitement ran high until it was ascertained that there was no ground for alarm. The original cause of the mischief was the giving out of the fuses in the circuit-box.

The Free Supply of Electricity at South Shields.

We learn from a local paper that the offer of the South Shields Corporation to afford a free supply of electric current during three months ending July to all new customers who applied within that period, to which reference has already been made, has, on the whole, proved a distinct success. Some fifty tradesmen and householders took advantage of the offer, and on the day following that on which the offer closed, seven applications for electric light were received; bringing up the total to 57. The object of the Corporation was, in the first place, to get new consumers to make their applications early in the summer, so as to avoid the rush in the autumn, and at the same time to keep the men regularly employed during the slack period; and, secondly, to popularize the electric light in the town. Both of these ends have, it is said, been achieved to a certain extent, and at a remarkably low cost. It appears that the light supplied free to the new customers during the period mentioned only cost £9; and it is stated that the new customers have in reality only consumed the current which, had they not been switched on, would have "run to waste." The annual income which will be derived from the 57 new consumers is expected to amount to many hundreds of pounds. This is all very well; but what about the action taken by certain discontented ratepayers to contest the legality of this "free" supply?

Chesterfield.

According to what appears in the local papers, Chesterfield has no reason to rejoice at having undertaken electric lighting. One of the members of the Town Council gave a few disquieting figures in regard to the venture at a recent meeting of the Ratepayers' Association; and he subsequently amplified them from his place in the Council Chamber. The gross profit realized up to the present time is £1116; but, of course, this is subject to the payment of interest, the liquidation of the loan, and the allowance for depreciation. When these trifles are taken into account, it appears that the profit of £1116 is converted into a loss of £3300. Even assuming that the repayment of the loan is equivalent, as the worthy Councillor contended, to making an allowance for depreciation, and that consequently the gross profit has only to bear the charge for interest on the borrowed money, still this would more than swallow up the profit. It looks, therefore, very much as though the rates would have to come to the assistance of the undertaking. This would be bearable if the lighting of the town had been greatly improved by the substitution of electricity for gas; but this is not so. We read that the arc lights are "an annoyance and a menace to the safety of vehicular traffic; casting heavy shadows, and flickering and starting in a manner most trying to human beings, and much more to horses." Would it not be well for the Watch Committee to turn their attention to the capabilities of the Welsbach system?

Opposition to Electric Lighting at Nantwich.

Last Wednesday, Colonel W. Langton Coke, M.Inst.C.E., held an inquiry at Nantwich regarding an application by the Urban District Council to borrow £12,505 for electric lighting purposes, and £1275 for the erection of a refuse destructor. Evidence in support of the application was given by the Clerk and Surveyor to the Council, and by Mr. Peers, an electrical engineer of Manchester. The scheme provided for the erection of generating works and a refuse destructor on the Council's sewage farm close to the town, and for the same motive power to be used for both purposes. A memorial in favour of the scheme, from certain manufacturers and tradesmen, complaining that they were unable to compete with those of other towns owing to the high price charged for gas, was read. The annual payments were estimated at £1932, and the income at £2440; this sum including £2250 which it was anticipated would be derived from the sale of electricity to the public at a charge of 6d. per unit. Mr. W. Harvey, a former member of the Council and a large ratepayer, while approving of the erection of a destructor, strongly objected to the introduction of the electric light, which would, he said, impose a permanent burden on the ratepayers. Two questions of vital importance to the town were the sewage and water questions; and these ought to have been dealt with before the Council embarked on the present scheme. Mr. H. Martin, solicitor, objected on similar grounds. In cross-examination, Mr. Martin said he was a Director of the Gas Company; but he should be pleased to surrender the few shares he had if by doing so Nantwich would be spared a burden which would be enormous. Other ratepayers opposed the application. In closing the inquiry, Colonel Coke promised that the representations made should be placed before the Local Government Board.

Arbitration and Conciliation in Trade Disputes.—The Premier of New Zealand (the Hon. Richard Seddon) last Thursday night addressed in Liverpool the workmen employed at Hudson's Soap-Works. He eulogized the care manifested towards the employees, and said he heartily wished workmen were as well looked after in England as in New Zealand, whereby misunderstandings were removed. If the employers took an interest in their workpeople, they would work more cheerfully. In New Zealand strikes were unknown, and this resulted in harmonious working. Australia, he was glad to find, had copied the New Zealand Arbitration and Conciliation Acts; and in America there was an agitation in favour of a like measure. In New Zealand poverty was unknown, and they had no millionaires. He mentioned with pride that during the last ten years the accumulated thrift of New Zealand workers had increased by no less than £5,000,000.

THE DERWENT WATER SCHEME CONCISELY DESCRIBED.

At Meetings of the British Association of Water-Works Engineers, there are always a number of interesting papers circulated among the members describing the water-works in the neighbourhood of the meeting place—these productions being merely for information and not for discussion. One of these this year dealt with the great Derwent water scheme; and as it is from the pen of Mr. J. B. EVERARD, M.Inst.C.E., the Consulting Water Engineer of the Leicester Corporation, and gives succinctly the salient features of the great undertaking and other matters affecting the Water Board and their powers, we publish it *in extenso*. Mr. Everard writes:

It is now about 38 years since the writer's first introduction to the sources of the River Derwent. One wet day he walked with some friends from the Yorkshire Moors above Woodhead into the Derwent gathering-ground, and, following the course of the stream as it flowed through the grouse moors of the Dukes of Norfolk and Devonshire, noticed it gradually growing as it was joined by its early tributary, the River West End, and numerous cloughs and brooks, until its arrival at the tiny village of Ashopton, where it is joined by the River Ashop. Whether it was the romantic nature of the gathering-ground, or the exceedingly wet day which might be likely to impress a water question on the mind, or, perhaps, what is more likely, a visit paid about the same time to the scene of the awful desolation caused by the bursting of the Dale Dyke reservoir in the adjoining valley of the River Don, this situation remained impressed upon his mind as an ideal position for works of water supply.

It was not, however, until 1885, when the writer was investigating the available sources of supply for the Leicester Corporation, that the abstract impression began to grow into a concrete idea, and then only to be dismissed, as a source from 60 to 70 miles away scarcely seemed to rank under the head of available supplies for a town with a population of about 150,000, while anything nearer could be obtained.

In 1886, the Corporation tried to obtain what was known as the Blackbrook, but were defeated by Loughborough. In 1890, they did obtain powers to impound a small stream at Swithland with an available yield of under 2 million gallons per day. But while these works were being constructed, there occurred the dry years of 1892-1895, and Leicester practically suffered from a water famine. As the yield of all the sources, including Swithland, was barely 5 million gallons per day, and the population of the district of supply was approaching a quarter-of-a-million, it was evident that immediate steps would have to be taken to meet the growing needs of the town. An examination of the basin of the River Soar, upon which Leicester is built, and of the western and northern portions of the basin of the Trent, showed that it was only in the north that a suitable supply in quantity and quality could be obtained; and the Derwent came prominently to the front.

After a full consideration of the best available geological and meteorological data, and after obtaining analyses of the waters of the Derwent and Ashop, the author strongly advised the acquisition of this source. The area of the gathering-ground is about 32,000 acres, the greater part moorland, all lying at a higher altitude than 580·00 Ordnance datum, and having 26,800 acres lying above 1000·00 Ordnance datum, and 11,600 acres above 1500·00 Ordnance datum. The average rainfall will probably be found to be upwards of 47 inches per annum, and the hardness of the water is only 2 per cent. (Clarke's scale).

Fortunately, in Alderman Wood the Leicester Water Committee possessed a Chairman who had their confidence, and whose judgment was trusted by the town; and the Leicester Town Council decided to make application to Parliament for this supply. As soon as any public movement was made in the matter, it was found that other towns—Derby, Sheffield, and Nottingham—also considered that this source was a heaven-sent provision for their needs; and, as matters progressed, the counties of Derby, Nottingham, and Leicester also put in a claim. As the total available quantity of water, after allowing for river compensation, was only estimated at about 33 million gallons per day, it was soon seen that all the interested parties could not obtain all they wished; and conferences were held to try and amicably adjust the claims. These not being successful, separate Bills were promoted by the towns of Leicester, Derby, and Sheffield, and separate surveys made and works designed—the Engineers for Derby being Messrs. T. & C. Hawksley; for Sheffield, Mr. E. M. Eaton; and for Leicester, the author.

The only general interest attaching to these three separate schemes was in connection with the different works adopted for utilizing the same waters by three Engineers acting independently. Geologically, both the Derwent and Ashop Valleys are in the Yoredale series of shales and sandstones; but the reservoir sites in the Derwent Valley are far superior to those in the Ashop Valley.

In the Ashop Valley there was only one good site, at a place known as Hagglee, situated at a sufficient altitude for town supply; and this was selected both by Leicester and Derby. Sheffield did not propose a reservoir in the Ashop Valley, but designed a tunnel to carry the upper water of the Ashop under the adjoining hill into the Derwent Valley, enlarging the reservoirs on the Derwent to act as a storage for both rivers. Leicester proposed a small reservoir higher up the Ashop Valley, in case arrangements could be made for giving less than one-third of the available water to the river; but when this point was unfavourably decided, the higher reservoir was abandoned—the site not being a good one. Derby proposed a reservoir near the bottom of the Ashop Valley for compensation purposes.

In the Derwent Valley, Derby proposed three reservoirs, Leicester two, and Sheffield two. The Leicester reservoirs began rather higher up the valley, so as to provide for the greater distance the water had to be taken, and the greater final altitude of delivery. Below the junction of the two rivers, all three towns proposed a compensation reservoir at Bamford. These reservoirs were to occupy nearly the same positions, but varied somewhat in capacity. In order to utilize all the water in the neighbourhood, Derby also proposed reservoirs on the River Noe, in Edale, and on the Burbage Brook, near Longshawe; but these were abandoned early in the proceedings.

The total reservoir capacity proposed on the Derwent and Ashop was: For Derby, about 8988 million gallons; for Leicester, about 8580 million gallons; and for Sheffield, about 7820 million gallons.

As regards the works necessary for utilizing and distributing the stored water available for supply, there was more difference of opinion. Sheffield proposed to carry its portion by a tunnel about 4¾ miles long under Stannage Edge, beginning near the village of Ashopton and terminating near the Rivelin reservoirs of their present water-works. The other distributing works proposed by Sheffield were intended to intercept the works designed by Derby and Leicester, so as to pass part of the water by those works to the other interested places. Derby proposed to convey the water from the different reservoirs by mains under different heads down the valley of the Derwent to service reservoirs situated at different levels at Crich, Little Eaton, and Bargate. Leicester, who wished to get the water delivered at as high a level as possible near Leicester, proposed, by aqueduct with tunnel and cut-and-cover, to lose as little fall as possible on the way. The conduit beginning at the end of the tunnel from the Ashop Valley, at a level of 707·00 Ordnance datum, was carried by cut-and-cover and syphon pipes for 6¼ miles to a large area of filter-beds above Bamford, at a level of 699·00 Ordnance datum. From these filter-beds, the conduit was continued, partly in tunnel, partly cut-and-cover, and partly syphon pipes, down the valley of the Derwent for 22¾ miles, to large distributing service reservoirs near Ambergate, having a surface level of 637·00 Ordnance datum. About 2½ miles of this conduit is carried through Chatsworth Park; and the writer is pleased to take this opportunity of acknowledging the goodwill shown by the Duke of Devonshire, not only in giving every facility for the surveys at the source, but also in readily giving permission, and by his agent, Mr. Gilson Martin, assisting in the location of the line of conduit through the park.

Ambergate was selected as a convenient centre for distributing the water to the southern towns of Nottingham, Derby, and Leicester; the water for the latter town having still upwards of 31 miles to travel through pipes to the proposed service reservoir at Hallgates—these being at different altitudes, the highest level being about 500 Ordnance datum. At Hallgates, arrangements were made for distributing the water to the different parts of the supply district, and mixing it with the present sources.

From the first it was recognized that the county of Derby required special treatment, as the source was almost wholly in that county, and the River Derwent flowed for nearly its whole course through the county. The counties of Nottingham and Leicester had scarcely the same claim. The town of Nottingham, although not promoting a Bill, had a *locus standi* as being situated on the River Trent.

From these particulars, it will be seen that there were all the materials for a very pretty parliamentary fight; and this came off in the session of 1899. The details of this fight, although very interesting to the parties engaged, are not of general interest; but the results finally arrived at, by mutual concession among the places principally interested, assisted by the suggestions and decisions of the Committee presided over by Sir John Brunner, and which resulted in the passing of the Derwent Valley Water Act, 1899, are of general interest, as they represent the largest attempt that has been made for combined water supply, which must, as the years roll on, largely take the place of individual efforts.

It was recognized from the first that Leicester, although the most remote of the towns to be served, was in the most necessitous position, with a radidly growing population, situated in a highly cultivated district, and without underground sources. The position of Derby was similar, but the population to be served much less. Nottingham, although with a larger population than Leicester, had the underground supplies of the Bunter series to draw upon, and had recently acquired a site for a pumping-station. Sheffield, with the largest population, and lying the nearest to the source, was so situated that any water taken would be abstracted from the Trent basin; and it had large sources in the valley of the Don still unutilized.

The available water was divided as follows: To the local authorities in the county of Derby, outside the limits of supply of the borough of Derby, and outside the Rother Valley, what they required up to an aggregate of 5 million gallons per day.

To the local authorities of the county of Nottingham, 1 million gallons per day up to the year 1930. Subject to these provisions, the statutory division was: To the Derby Corporation, 25 per cent.; to the Leicester Corporation, 35·72 per cent.; to the Nottingham Corporation, 14·28 per cent.; and to the Sheffield Corporation, 25 per cent.

From the Leicester share, any corporation or urban or rural district in the county of Leicester, situated wholly or in part within 10 miles of the Leicester conduits, could demand water in bulk, but with a prior right at all times to the present Leicester water district to have 25 gallons per head per day. If any of the towns have a surplus of water, they have to offer it at cost price to the Board, who will offer it simultaneously to the other towns, and divide in the statutory proportion between the towns requiring more water. Subject to this provision, the interested towns can sell any surplus water within the counties of Derby, Leicester, and Nottingham, and part of South Yorkshire.

The necessary capital was to be provided in the above proportions by the four Corporations, the counties not providing any capital; but any places in the counties taking water were to pay for it at a *pro rata* price based upon 4 per cent. of the cost of the works executed, and a share of the maintenance, management, and working expenses.

The works were to be constructed and managed by a Board, consisting of thirteen members—four being from Leicester, three from Derby, three from Sheffield, two from Nottingham, and one from the county of Derby, and a standing Arbitrator was to be appointed.

The works authorized by the Act were rather a hotch-pot taken from those shown upon all the three sets of plans prepared by Leicester, Derby, and Sheffield. These have been slightly modified by an Act of 1901; and the works which the Board are now carrying out are:

Two storage reservoirs in the valley of the Derwent, with subsidiary works, upon sites fixed by the Act of 1901. These sites slightly differ from any of those previously selected, but are nearer to the sites proposed by Derby and Sheffield than to those proposed by Leicester. Railways modified from the two plans of Derby and Leicester. The main conduit as proposed by Leicester, but slightly varied near Ashopton. Filter-beds at Bamford, as proposed by Leicester. Service reservoirs at Ambergate, as proposed by Leicester. Various pipes as proposed south of Ambergate, within the county of Derby, for supplying Derby and Leicester.

The Board has also power to carry one of the lines of pipes down the valley of the Derwent, as proposed in the Derby plans, and to make service reservoirs in connection with the supplies of the town and county of Derby, to build a storage reservoir at Bamford according to the Sheffield plans, a storage reservoir on the Ashop, near Ashopton, as proposed by Derby, and one at Hagglee, on the Ashop, as proposed by Leicester. The Act also gives power to the interested towns to construct certain works for utilizing the supply—to Sheffield for a tunnel under Stannage Edge, to Nottingham for taking water from Ambergate reservoir, to Derby for certain works of pipes and reservoirs south of Ambergate, and to Leicester for a bridge over the River Trent and lines of pipes to Hallgates, with reservoirs and distributing mains.

There were many provisions in the Act of more or less interest to engineers, including the question of stone dams *versus* earth embankments, the prevention of plumbism, and the ever-present water compensation question; but the most interesting was one in connection with the latter consideration.

No rain-gauges had been established on any part of the gathering-ground, so the rainfall had to be deduced from the rain-gauges in the adjoining districts. Rain-gauges were, however, established on the area; and observations taken while the surveys were being made, and up to the time of going before the Committee. But, as might be anticipated, these varied so much that it was not considered advisable to establish an average rainfall from such imperfect data, and two Referees were appointed—Mr. E. M. Eaton, and the late Mr. G. J. Symons, since whose lamented death Dr. Barwise, the Medical Officer of Health for Derbyshire, has acted.

It is the duty of these gentlemen to establish rain-gauges; and within six months after the 1st of January, 1906, determine the amount of available rainfall, and publish the same. The daily compensation water is to be discharged in a regular and continuous flow during each twenty-four hours, and is to be equivalent to $\frac{1}{365}$ part of one-third the ascertained available flow.

Early in their proceedings, the Board decided to carry out the works under their own Engineer and staff, and appointed Mr. Edward Sandeman (who had recently completed the large works at Plymouth) as their Chief Engineer. Although Mr. Sandeman was only appointed about two years since, he has organized his staff, prepared for, and assisted in obtaining, an amending Act of Parliament, built a village, nearly completed a railway about 7 miles long, and has begun the permanent work of excavating for the masonry dams. The work is now of an interesting character, and in another year will be full of engineering interest.

SHEFFIELD CORPORATION WATER SUPPLY.

Additional Powers Needed—Free Supply for Baths.

At the last Meeting of the Sheffield City Council, a recommendation by the Water Committee that the Council should promote a Bill next session to confer additional powers on the Corporation in regard to the water undertaking was considered.

Alderman GAINSFORD, the Chairman of the Committee, explained that the course recommended was necessary, in the first place, because of the altered conditions of the Derwent Valley aqueduct, which arose out of the Bill of the Derwent Valley Water Board last session. The aqueduct at Ashopton had been altered in position and height, and it would result in very advantageous changes in regard to the length of tunnelling they had to drive from Ashopton to Sheffield. They could drive at 50 feet higher, and reduce the length in consequence. Formerly, the length of the tunnelling would have been 8175 yards; now it would be 7640 yards—a saving of 535 yards. Then more money was required for the Little Don works. The amount they were authorized to expend by the Act of 1896 was £800,000, which was not only for the Little Don works, but also for the current capital expenditure. Out of that money, up to the 26th of July this year, there had been spent on the works £575,000, and on other current capital expenditure of the Water Department, £135,000—a total of £710,000. There was therefore left unexpended about £90,000. This would be quite insufficient for completing the works and going on probably beyond the end of next year. Another provision which it was wished to obtain was to allow of the application from time to time, subject to certain restrictions, of the surplus money resulting from the working of the Water Department to various objects for the general good of the city. At present, the Council had no such power, and could not take a penny of the water revenue except for merely routine purposes. It was generally admitted that, under certain restrictions, the Council should have the power to make somewhat more general use of the money which accrued from the working of the department. The proposed restrictions consisted in this—that no grant should be made from the water surplus unless there was a balance of £100,000 in hand, and that a vote of such money should only be made by an absolute majority of the whole of the Council. The latter clause meant that, unless 33 members voted for the disposal of such money, a resolution with that object could not succeed.

Mr. H. P. MARSH moved, as an amendment, that so much of the minutes of the Water Committee as recommended the Council to promote a Bill for making grants out of the surplus water revenue on certain conditions therein specified, be not confirmed, but that a further condition be added—that no such grant be made until water is supplied within the city of Sheffield for baths and water-closets free of charge to the owners or occupiers. He pointed out that the ratepayers were already paying for these necessities in the rates.

Alderman GAINSFORD pointed out that power to do so was contained in the Bill itself, which proposed to devote part of the surplus to this object. The Water Committee were heartily in favour of doing what Mr. Marsh desired; but the Act was necessary to enable them to do it. This amendment would tie the hands of the Council.

Alderman Sir CHARLES SKELTON seconded the amendment. He pointed out that the surplus which the Water Committee sought power to disburse had been improperly extracted from the pockets of the ratepayers, though, no doubt, it was done legally.

Alderman GAINSFORD said he could not accept the amendment, for it would tie their hands entirely. The whole surplus would be swamped if this resolution were carried.

On a vote being taken, the amendment was carried by 28 votes to 19—the Lord Mayor (Alderman G. Senior) remaining neutral.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Glasgow Corporation gas accounts were approved by the Corporation on Thursday, and I have sent you a report of the discussion which took place thereon [see p. 574]. In submitting them, Mr. R. M. Mitchell, the Convener of the Gas Committee, made, as is his custom, a short but pointed speech, which contained as much information as the non technical public could understand. Usually the Convener's motion is adopted almost without remark; but this year, with the proposed institution of differential rates, some members of the Town Council waxed so bold as to move a counter-motion. The Council have a leaning towards the policy of making all alike. They have followed this course from 1876. Indeed, so rigid has been their adherence to it that since then not even discounts have been allowed to large consumers. But now, after due deliberation, it has been resolved to give the users of gas for power purposes the privilege of having it at a lower rate than those who employ it in other ways. Taking the step which has been resolved upon as an experiment which, if successful, will be followed by reductions in the price of gas used for other industrial purposes, it is certainly right. There is a principle in it which the opponents of the proposal seemed unable to discern. It is that gas which is used so as to provide labour—that is, so as to give employment to others—should be charged to the person taking it at a lower rate than the gas purchased for merely personal use. This is a principle which enters into all commercial and industrial life; and it is altogether reasonable. It was remarked by one of the speakers that the principle will probably be extended; and the Convener said something about the Provan works, which rather looks as if the Committee are feeling their way into this business—knowing that at present they would have difficulty in meeting any sudden demand for gas if they were to reduce the price all round, but knowing also that when the Provan works are opened they will be in a position to meet any call, however great. They believe, further, that, from their experience in the matter of supplying cheaper gas for power purposes, they will be able to say what more they should do in the matter of concession. The Committee on Electricity intimate, in their report, that they are considering the subject of the utilization of gas-engines for the generation of electricity. Their minds are running upon the notion of employing producer gas—of their own manufacture, I presume. This step of the Gas Committee may be the means of retaining them as customers of the gas undertaking, and thus both departments may benefit.

Mr. Scott Gibson, who imagines that there are Augean stables in Corporation departments which it is his duty to clean out, called in question, at last Thursday's meeting, the method of buying coal for the gas-works. He did not attempt to give any reason for his suggestion; only he thought it would be better to buy coal for six months instead of for a year, because there is a possibility of a fall in prices. His thoughts, however, do not rule in the coal market. There is a long distance between what Mr. Gibson may think and what those think who have coal to sell. In this matter the Gas Committee are supreme; and anyone who should propose another arrangement would not be acting in the interest of the department. The Committee have experience in the matter of buying coal; we do not know what Mr. Gibson's may be. But the Corporation have had experience of him during the past year, and always in the same *rôle*—that of fault-finder. The step he suggested in connection with the purchase of gas coal would, in my opinion, not have been to the benefit of the gas undertaking. I believe we do not require to go far back for proof of this view. The Council, however, knew all that; and when Mr. Gibson had had his tilt at the Committee, they gave the action of that body their approval, and passed on to other business.

The electricity accounts which were adopted at this week's meeting of the Glasgow Town Council [see p. 576] contain material which should give rise to serious reflections in the minds of ratepayers in the city; and they are also not uninstructive to many who are not financially interested in them. Perhaps the leading thought which they stir is the mushroom-like growth of the electricity undertaking. But a few years ago it was not in existence; the department only dating from 1893. Yet at the present time it rears its head among the other departments, with a capital of £1,017,000. The thought would naturally arise in the mind of one uninformed, that surely this must be an undertaking for the supply of something which is in universal demand—something of the use of which mankind was in blissful ignorance until quite recent times, but which is now indispensable for the happiness and comfort of the people. The accounts, however, show that such a conclusion would be a hasty one indeed. This great capital has been expended for the supply of electricity to 5374 private consumers, and to the Corporation of Glasgow for public lighting. The capital expenditure is at the rate of about £190 per consumer. The

revenue from electricity amounted to £97,050; thus every consumer must have, on an average, contributed £16 to the revenue. We never hear now of electricity being the "poor man's light," and no wonder. Certainly no one in Glasgow can say it is. Contrast the results with those which emerge from a perusal of the Corporation's gas accounts. In that department the capital amounts to £1,438,065, and the consumers number 209,737. The capital outlay per consumer is less than £7; and the average gas account, to raise the revenue of £699,416 from the sale of gas, only required to be £3 5s. The accounts are neither of them in a favourable position for comparison, because both contain large outlays in extensions of works; but, taking them as they are, it is apparent that while in the Gas Department the capital outlay during the year was £194,000, and 3193 new consumers were obtained, in the Electricity Department the capital outlay was £138,000, and the new consumers numbered only 1343. All these results are telling. But what about the future? Where is the expenditure upon electricity to end? The accounts show that the outlay upon mains and cables was by far the largest of all the items of capital expenditure. The city is not yet encompassed by the mains of the department. By the time it is, where will the capital account be? And what will be the gross outlay on the part of the public upon services and fittings, in addition to that of the Committee upon mains and other plant for the supply of current? Truly, the burden which is being placed upon the shoulders of the ratepayers of Glasgow is no light one; and the prospect is that it will become much heavier yet. Plant which is little more than ten years old is already being thrown aside as obsolete. Where is this process to stop? If new plant is to be provided every decade, no amount of sinking fund or depreciation will ever keep anything like pace with it. There is a vista of expansion here which is truly alarming, and which surely teaches the lesson that the business has been, and is being, rushed beyond its natural capacity. Instead of waiting for a demand, it has been assumed that the supply would create the demand; and works have been put down at enormous expense, which the public are not using. The credit of the general public has been pledged as security for outlay on behalf of a few. That is the situation in brief. The accounts prove it. The differential rates charged are something marvellous. Starting with 6d. per unit as what may be called the standard price, the rates are graded down, according to the quantity consumed, till the charge is only 1d. per unit. Of the 8 million odd units sold, about one-fourth only were charged at 6d. per unit. More than this was sold at 1d. per unit; while at charges for 1d. and 1½d. per unit, upwards of half of the consumption is accounted for. The 6d. rate only produced a total revenue of £1005; the 1d. rate produced £10,629; and the 1½d. rate £9528. It thus appears that the one class benefited, at the expense of smaller consumers, to the amount of £50,000, and the other to the amount of £27,000. This is surely overdoing the theory of giving benefit to larger consumers. All this shows upon how unsatisfactory a foundation the electricity business is founded. And we, who are more concerned with gas supply, must, on a perusal of these accounts, feel grateful that we are in a very different position. The gas industry is, financially, well in hand; the electric lighting industry is lamentably out of hand.

A great deal of energy has been developed this week in the matter of the filling up of the vacant post of Gas Manager in Dundee; but it has, I am afraid, been more motion than progress. First, on Wednesday, we were treated to the information that the work of reconstructing the retorts in the gas-works was proceeding apace, and that, so far, the results were considered to be highly satisfactory; that a number of the retorts which had been rebuilt and provided with baffles had been in operation for some time, and were producing 10,500 cubic feet of gas per ton of coal carbonized, which was practically equal to the capacity of the coal as tested by analysis; and that a staff of bricklayers are employed on the reconstruction of the other retorts. Then, on Thursday, we were informed that, acting upon the instructions given by the Town Council, the Town Clerk had prepared a list of the 35 applicants, together with a synopsis of their qualifications as contained in their testimonials; that the nature of the training and experience of each applicant was given, and also the situations he had occupied; and that the paper had been issued to the members of the Council. To-day we are told that a meeting of the Gas Committee was held yesterday, to which all the members of the Town Council were called, and at which there was a good attendance, and that it was resolved to remit to the Gas Committee to draw up a short list of nine. I feel that the stage of appointment must be reached soon now; but I cannot conceal from myself the fact that a most roundabout way has been taken in the filling up of the vacancy. The document which is now called a list with a synopsis of qualifications, and which was originally termed a vidimus of the applications, seems to me to be a superfluity, and its preparation to have resulted only in unnecessary delay. Its uselessness is to be seen in the fact that, with it in their hands, the Gas Committee last night, *plus* other members of the Town Council, could not even reduce the list to the short one, but were obliged to ask the Committee to do it for them. I would like very much to be able to furnish you with a copy of this strange document, for the guidance, or warning, of other bodies who may come to have like business before them.

At yesterday's meeting of the Gas Committee, it was stated by Mr. Ballingall, the Convener, that it has been discovered that the fire-bricks in one of the new chimneys at the gas-works have been burned, and will require to be renewed; that it appears that gas had escaped up the flue, and on mixing with the air at the top of the chimney, had taken fire and burned the bricks for about six feet; and that the copper bolts on the outside of the chimney, which held the lightning conductor, have also been fused by the heat. Mr. Ballingall asked, as the matter admitted of no delay, authority to have the chimney repaired at once, and this was agreed to. Now, although it is not stated, there can be no doubt but that it was the furnace gases which have done this mischief, and that the cause of it was too small a supply of air for combustion in the ovens. The notion which the public will derive

GAS

Some people make

LIGHT

of it.

We

COOK

with

it!

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from the statement will, I presume, be that the gas which burned at the top of the chimney was gas which escaped from the retorts, and that this explains the low yield of gas per ton of coal. But that is not so. The circumstance is, however, one which will bear looking into, because if, in the reconstruction of the ovens, even the placing of the baffles—which, by the way, seems to be regarded by the Dundee Town Councillors as the cure-all of the situation—the air supply be not increased, the trouble will re-appear. It is not said whether the burning out of the fire-brick took place before or after the reconstruction, which, surely, is a matter of the very utmost importance, and ought to be seen to at once.

The Corporation of Greenock had the accounts of the gas undertaking of the town for the year before them on Tuesday. The capital account stands at £182,960; but the Corporation are in the happy position of having £92,838, which is more than half of that sum paid off—leaving the burden of capital on the undertaking at £90,122. Of few undertakings can it be said that they have been able to repay more than half of their capital. The capital outlay upon the works has been £155,944, the year's contribution to which was only £843. There is an extensions capital account, which stands at £10,748 (the sum of £9904 having been expended before June, 1901). The total revenue was £55,878, of which £49,050 was derived from the sale of gas, £389 from gas-stoves, and £6329 from the sale of residuals (£1729 from coke and breeze, £2032 from tar, £310 from naphtha, and £3560 from ammoniacal liquor and sulphate of ammonia). In the amount of revenue from gas I observe that £2668 is included as the estimated sum due for gas consumed from May 7 to June 30—that is, from the date of the previous survey. The total expenditure amounted to £42,741; and there is left a balance on the year's working of £13,137. Coal, including carriage, cost £23,819, purifying material £1493, salaries £725, wages £5501, and repairs and maintenance of works and plant £1584. The total cost of the manufacture of gas was £33,515. Distribution cost £1876, repairs, &c., to gas-stoves £187, depreciation upon gas-stoves, £202, the lighting and repairing of public lamps £2676, rents, rates, and taxes £2066, management £1895, insurances (including £55 6s. 4d. under the Workmen's Compensation Act) £92, and retiring allowances £172. The book-keeping is somewhat complicated, but after meeting interest (£2678), sinking funds (£5000), and extraordinary expenditure (£1801), there is a balance brought out of £3730. Going further, the book-keeper proceeds to deduct the estimated proportion of revenue applicable to the period from May 7 to June 30, less sums paid for last year's accounts, and brings out a net surplus for the year of £1632. The sinking fund is stated at £92,757; but all of it, with the exception of £80, has been applied in the redemption of mortgages. In the manufacturing department, 31,389 tons of coal were carbonized, yielding 314,377,000 cubic feet of gas, as compared with 32,607 tons of coal and 302,012,800 feet of gas in the preceding year. The average price per ton of coal was 14s. 9·42d., as compared with 15s. 10·96d. Leakage amounted to 12·87 as compared with 11·78 per cent.

In presenting the accounts, Mr. Morison, a member of the Gas Committee, said it was estimated that the year's revenue from gas would amount to £45,050; and it had amounted to £46,311, or £1261 more. This represented an increased sale of gas of about 8 million cubic feet. The make of gas had increased by 12 million cubic feet, and it was to be regretted that 4 millions had been lost. The leakage of gas was increasing much faster than the output, which, he supposed, was due to the pressure required to force into the town a volume of gas exceeding the natural capacity of the main from the works. It was estimated that they would get £9800 for residuals; but they had only received £7631, which was £2169 less than the estimate, and £250 less than in 1901. The reduction was not surprising. Other Corporations had suffered even more severely from the fall in the coke market. The gross revenue was £1176 more than in 1901. The expenditure had been about £100 over the estimate. Notwithstanding the increase in the make of gas, the coal bill did not exceed the estimate. This was because the Manager (Mr. W Ewing) took more gas out of the coal than he promised. As he (Mr. Morison) last year expressed a doubt as to his ability to secure his estimated make per ton of coal, he now, in justice to the Manager, frankly admitted that he had done even more. They were able to apply £3000 to the reduction of the deficit of the two previous years (£4900), leaving £1900 which would require to be wiped out in the current year. The report and accounts were, after some discussion, adopted. The principal topic of conversation was as to the condition of one of the gasholders. With reference to it, it has been reported to the Corporation, by a firm of engineers, that there is considerable leakage from it, and that if there should be straining at the cupping an accident might happen. On the other hand, the Manager takes the view that the holder is perfectly safe, and only requires a few trifling repairs. To settle the matter, it has been resolved to ask a report on the subject from Mr. T. Wilson, of Coatbridge. There was some adverse criticism as to the quality of the gas; but this is so common that I pass over it. Some other points in connection with the gas supply, however, I should like to refer to; but I must hold them over till another week.

The gas accounts for the past year were before the Peterhead Town Council last week. Mr. Ritchie, the Convener of the Gas Committee, said it was with some feelings of disappointment that he was not in a position to submit an account of last year's operations indicating a continuance of the favourable surpluses that had marked the accounts of the previous year. The accounts on this occasion showed that the expenditure and liabilities had exceeded their revenue by £707. This sum, though it looked a large one to drop on the year's operations, was not to be wondered at, taking into account the great reduction they had to face in the price obtainable for their residuals, coupled with exceptional and unlooked for increases under each head of general expenditure and liability connected with the carrying on of the works. It would, however, be some satisfaction to them and to their customers generally to know that, notwithstanding the loss of profit, the Committee did not intend to raise the price of gas to any class of consumer.

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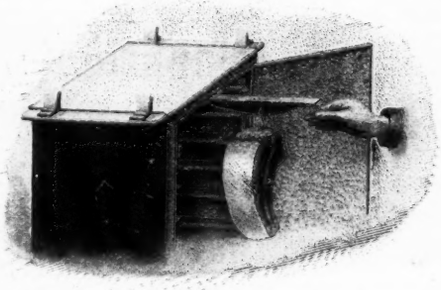
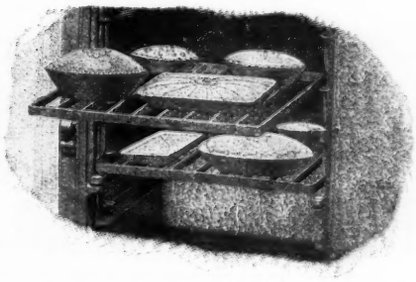
Patent Sliding Meat Hook.



Patent Self-Locking Grid Shelf.



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LONDON
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During the year ending May last, they had sold not less than 3¾ million cubic feet of gas more than the year before, or 24 millions in all; giving them a revenue of £4587, or £302 over the amount realized the previous year. This result was achieved notwithstanding the reduction of 7d. last year—a reduction that would have been equivalent to another £722 of revenue had the price remained as it was. Unfortunately, while their revenue from gas sold had shown such a gratifying increase, the receipts from residuals had been very much the reverse. The failure of the revenue to cover the liability had resulted directly from what might be termed their over-eager desire to please their consumers by a premature reduction in the price of gas. Had it not been for the reduction, they would have shown a favourable balance as usual, even in spite of greatly increased expenditure. The heaviest of the items for renewals to plant, &c., had been in connection with the old exhauster, steam-boiler, and work connected with utilizing the natural water supply at the works. The Committee had been in full accord with the Engineer and Manager in the carrying out of all the improvements, and were fully satisfied the money had been beneficially spent. Less expenditure was anticipated next year. They were, however, face to face with the necessity of making some improvements that would involve a large capital expenditure. They found that their condensing, washing, and scrubbing plant was far too small to accomplish the work it was called upon to do. During the present year, they anticipated an increase in the gas consumption of at least 8 per cent., though during the past two months it had averaged 16 per cent., which would yield an additional revenue of £450. Coal would be about 6d. per ton less, a saving of £120; and from residuals they anticipated £1200 or thereby, having contracted for the greater part at an advance upon last year. If these anticipations were realized, they should have no difficulty in making up the deficiency of the past year, if they did not show a balance to the good.

The Bo'ness Gas Company have reduced the price of gas from 4s. 2d. to 3s. 9d. per 1000 cubic feet. They also submitted to the Town Council a tender to supply gas for public lighting at the rate of 13s. 6d. a year for ordinary lamps, and 31s. 6d. a year for all-night lamps (a reduction of 10 per cent. upon the past year), and reducing the upkeep of the lamps by 3d. each. This came before the Town Council last week; and, after a little badinage, it was accepted.

At the Kilsyth Town Council last week, Mr. Trewy, the Convener of the Gas Committee, reported that the North British Railway Company had approved of an agreement for the construction of a railway siding into the gas-works, and that the agreement was now in the hands of the Caledonian Railway Company for their approval. Damage, it was reported, had been done at the gas-works by underground mineral workings, and the Clerk was instructed to look into the matter.

The Directors of Messrs. A. & J. Stewart and Menzies, Limited, have declared an interim dividend for the half year ended June 30 at the rate of 9 per cent. per annum on the ordinary shares.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 23.

Sulphate of Ammonia.

There has been good demand, and the limited quantity offered for prompt delivery has been readily disposed of at hardening prices. The closing quotations are £12 per ton f.o.b. Hull, £12 2s. 6d. per ton f.o.b. Leith, and £12 3s. 9d. per ton f.o.b. Liverpool. For September delivery, there has also been good inquiry, but for this position buyers have not been willing to pay prompt prices, hoping for a decline with the larger September production. On the other hand makers, having no stocks to carry forward, are unwilling to sell at a discount. There has been renewed interest in October-March delivery, and at the close there are buyers at £11 10s. per ton f.o.b. Leith, but makers now require £11 15s. per ton. London, Beckton terms, is also held for £11 15s. per ton.

Nitrate of Soda.

This is steady on spot at 8s. 4½d. to 8s. 7½d. per cwt., according to quality, while ordinary quality, for spring delivery, is quoted at 8s. 9d. per cwt.

LONDON, *Aug.* 23.

Tar Products.

The markets are decidedly quiet all round; but the demand for pitch still continues very good for home consumption, especially as regards prompt delivery. The demand for shipment is now entirely for next season. There are inquiries in the market for July-December, 1903, which appears a long way forward to contract; but as a rule distillers are "shy" of selling so far forward before they have secured their tar. Crude carbolic is weaker. Sixty's have been sold at 1s. 8d. for September, while consumers now offer only 1s. 7d. for October-December. Crystals continue quiet. Small sales of 34-35's and 39-40's have taken place at exceptionally low prices, and under the quotations given by makers. There is a slightly improved demand for creosote, especially for prompt delivery, but prices remain unchanged. As regards solvent and toluol, there is no demand for either article. Quotations are purely nominal; consumers taking no interest in same. In 90 per cent. benzol, business is reported at 8d. for forward delivery, but only to a limited extent. There are some inquiries for January-June next; but manufacturers do not care to contract so far forward, except at an improved price. There is practically no demand for 50 90 per cent. The market for anthracene is quiet; but there does not now appear to be any demand except for specially high qualities. Consumers are prepared to entertain business for next year at existing prices; but manufacturers, as a rule, decline to contract—there being considerable uncertainty with many of them as to whether they will produce the article at all, unless values improve considerably.

The average values during the week were: Tar, 18s. to 22s. 6d. Pitch, London, 50s. to 52s.; east coast, 47s. 6d. to 48s. 6d.; west

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coast, 43s. 6d. to 44s. Benzol, 90 per cent., 7¾d. to 8d.; 50-90 per cent., 7d. Toluol, 7½d. to 8d. Crude naphtha, 2½d.; solvent naphtha, 8d. to 8½d.; heavy naphtha, 9d. to 10d. Creosote, London, 1¼d.; North, 1d. Heavy oils, 1⅞d. Carbolic acid, 60 per cent., 1s. 8d. Naphthalene, 30s. to 47s. 6d.; salts, 20s. to 22s. Anthracene, "A," 1½d. to 1¾d.; "B," 1d. nominal.

Sulphate of Ammonia.

The markets are steady all round; and there is a very good demand for prompt delivery. The Gaslight and Coke Company are not offering any Beckton for prompt, but could deliver a little in September, for which they ask £12, and expect to realize same. For October-March, their price is £11 15s.; but it is probable they would accept a little less with a firm offer, as the demand forward is not very strong. Another of the large London Gas Companies placed a considerable quantity at £12, on their own special terms, for August shipment, and are now only sellers for September. In Hull, business has been done at £11 17s. 6d. and £11 18s. 9d. for prompt delivery, while £12 was offered, in one instance, for immediate shipment. For October-March, there are sellers at £11 7s. 6d.; but at present consumers will not purchase so far forward, except at a lower figure. Manufacturers, however, are not disposed to reduce their price. In Leith, the demand is very good for prompt delivery, and £12 to £12 1s. 3d. was paid during the week; but sellers are quoting £12 2s. 6d. for prompt shipment, and expect to realize it. As regards forward delivery, there is nothing to report.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Business in the coal trade of this district is moving on in much the same steady fashion as reported of late; the restricted output of the collieries checking any large surplus supplies coming upon the market, and prices are being well maintained. So far as the better qualities are concerned, it may be taken as settled that current rates are at the minimum they are likely to touch this year, and if there is to be any change it will be in the direction of some hardening on present quotations, which are firm at 13s. 6d. to 14s per ton at the pit for best Wigan Arley, 12s. to 12s. 6d. for Pemberton four feet and seconds Arley, and 9s. 6d. to 10s. for common house coal. The lower qualities of round coal, although there is only a moderate inland demand for steam and forge purposes, and a continued indifferent shipping business, are meeting with still more inquiry for common house-fire purposes; and supplies are not quite so plentiful on the market as a short time back, with the result that there is a steadying in prices, except that shipping orders for special clearance lots are taken at low figures. On inland sales, 8s. 6d. to 9s. remain the average figures at the pit for ordinary descriptions of steam and forge coal, with good qualities of steam coal quoted at 9s. 6d. to 10s., although special sales in some instances are reported at 6d. under these figures. Except that here and there, owing to holiday stoppages of mills and works, collieries have temporarily a surplus of engine fuel just now on their hands, all the better descriptions of slack are in brisk request, and prices, taking them all through, are very firm, with a hardening where contracts for forward delivery are wanted—advances of 3d. per ton on current rates being obtained in some instances. Best Lancashire slack is firm at from 6s. 6d. to 7s per ton at the pit, with medium sorts averaging 6s., and the commoner descriptions 4s. 9d. to 5s. Coke continues in active demand, inquiries in some cases being considerably beyond what makers are able to supply. Prices are exceedingly strong at 22s. to 24s for foundry, and 13s. 6d. to 14s. 6d. for furnace cokes, at the ovens, with an occasional hadening on these rates where new business is put forward—advances of 6d. per ton being got in some cases.

Northern Coal Trade.

There is now a steady demand for coals, but without much rush in the inquiry, as the production has returned to its normal extent, and thus the demand is well met. Best steam coals are firm, and the price may be taken as fairly steady at about 11s. 6d. per ton. Second-class steams are more plentiful at from 9s. 9d. to 10s. 6d. per ton f.o.b.; while steam smalls are from 5s. to 5s. 6d. In the gas coal trade, the demand begins to show signs of more rapid increase, though it is still moderate, and the quantities taken on contracts are not very great yet. Very best Durham gas coal is fairly well sold, and thus holds its own in price, at about 9s. 6d. to 9s. 9d. per ton f.o.b.; while from that down to about 9s. may be taken as the fluctuations of the less preferred qualities, of which there is more available for occasional sales. In the coke trade, the demand is full, and the prices firmer—best Durham coke for export being 17s. 9d. to 18s. 3d. per ton f.o.b. Blast-furnace coke is steady at about 15s. 9d. per ton at the furnaces. In gas coke, there is the benefit due to the improvement in other kinds just referred to, and also to its comparative scarcity; and from 11s. 9d. to 12s. f.o.b. are the quoted prices.

Scotch Coal Trade.

Trade is steady. It is believed that prices will not go lower. In the meantime, users of coal are endeavouring to stock, in the expectation of busier times, which helps to prevent further lowering of prices. The quotations are: Main 8s. 3d. to 8s. 6d. per ton f.o.b. Glasgow, ell 9s. 3d. to 10s. 3d., and splint 9s. 6d. The shipments for the week amounted to 254,832 tons—an increase of 6949 tons upon the previous week, and of 31,153 tons upon the corresponding week of last year. For the year to date, the total shipments have been 6,484,516 tons—an increase of 476,415 tons upon the same period of last year.

Water-works to supply the town of Shimonoseki, in Japan, have been sanctioned, the expense to be borne partly by the Government and partly by the town. The supply is to come from Itsuimura, 7½ miles distant. The estimated cost is about £102,000. The population at the end of 1901 was 44,283.

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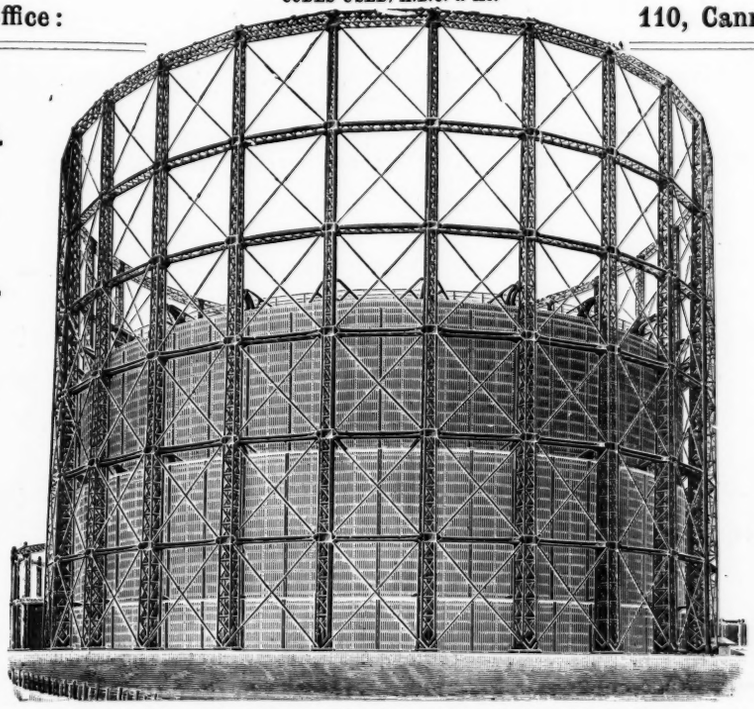

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RETORT-MOUTHPIECES.
SLIDE-VALVES, TAR-BURNERS, SIEVES.

GASHOLDERS.

Issue of Preference Stock by the Newcastle Gas Company.—The tenders invited for a new issue of 4 per cent. preference stock of the Newcastle and Gateshead Gas Company were duly sent in. The amount required was about £12,725; and the lowest tender acceptable was at £105 per cent. So much more money was offered than is wanted that those tendering at the minimum price fixed by the Directors of the Company will only receive stock to not quite half the amount they applied for.

Leeds Gas-Coal Contracts.—We learn from the "Yorkshire Post" that the Gas Committee of the Leeds Corporation have now completed their arrangements for the purchase of coal for the ensuing year, and have obtained an average reduction of 1s. 6d. per ton on last year's prices. On the basis of an annual consumption of 320,000 tons, this represents a saving to the Corporation of no less than £24,000 for the year. It may be remembered that last year the Committee obtained a reduction of 3s. 6d. a ton, so that the prices are now practically those which ruled before the advance of 5s. in 1900. The coal has been bought by private treaty, and the whole of it, with the exception of a small quantity of cannel from Derbyshire, has been ordered from Yorkshire collieries; the contracts being spread over a wide area. It is reported that they included between twenty and thirty firms.

Cost of the Colwyn Bay Gas-Works.—A special meeting of the Colwyn Bay and Colwyn Urban District Council has just been held for the purpose of completing the financial arrangements in connection with the purchase of the gas-works. Mr. G. Bevan, the Chairman, presided; and Mr. Chamberlain, solicitor, of Llandudno, who acted for the Council in the matter, was in attendance. A resolution authorizing the sealing of the deed to effect the transfer of the loan of £54,706 from the North and South Wales Bank, Limited, to the Provident Clerks' Mutual Life Assurance Association was carried. The money was temporarily advanced by the bank as the purchase price of the undertaking, which was paid to the Gas Company when the works were taken over at the beginning of the present year. Mr. Chamberlain has now negotiated the loan from the Association, to be redeemed in forty years; the interest payable thereon being 3¾ per cent. The Council also sealed a mortgage to the same Association for the further sum of £4500, at 3½ per cent., for the expenses, &c., connected with the purchase and transfer of the gas undertaking. The items of this amount are; The Council's costs in the arbitration, estimated at £1000; the Company's costs, £994; Arbitrators' fees, £632; stamp duty on the Act of Parliament and the transfer duty, £319; compensation to the Secretary of the Company, £900; estimated cost of the loan, £500; and estimated cost of winding up the Company, £200. The Council have also taken over a mortgage upon the works of £4900 at 3½ per cent., and the cost of the Act of Parliament was £1009; making the total cost of the works to date, inclusive of all expenses, £65,219. The Chairman, in answer to a question, stated that there was another claim to be dealt with for stores, amounting to a few hundred pounds; otherwise the transaction was now completed.

Colwyn Bay Water Dispute.—The Colwyn Bay Urban District Council have, on the advice of Counsel, decided to appeal against the adverse decision recently given by Mr. Justice Bigham in a claim by them for a rental from Llysfaen of £40 per annum for the two years ending 1900 for the use of the Colwyn Bay water-main (*ante*, p. 407).

Fatality at the Tideswell Gas-Works.—Last Friday, Mr. Sydney Taylor held an inquest on the body of William Greenhalgh, aged 18 years, who was killed at the Tideswell Gas-Works on Wednesday evening, during the taking down of a temporary gasholder. Mr. F. F. Harrison, Secretary to the Gas Company, said the same method was employed as when the holder was placed in position seven weeks ago—a crab, cross-legs, and guy-ropes being used. The iron stake which gave way and allowed the cross-legs to fall over, was driven into the ground about 3 ft. 6 in. The ground had not been disturbed to his knowledge for 15 years. Arthur Bell, of Chapeltown, who assisted in the work, and who had had seven years' experience in similar operations, considered the stake was quite safe. Fred Dawson said deceased assisted at the crab with another man. He heard the foreman shout "Keep clear." Witness ran clear, and Greenhalgh followed, but was struck on the head by the top of the pole. Deceased drove in the stake himself, and said it would "hold a town." Walter Gardner, foreman to Messrs. Newton, Chambers, and Co., Limited, who had charge of the work, agreed that the fatality was caused by the slipping of the stake. He tested it in the usual way, and considered it safe. The Jury came to the conclusion that there had been no negligence, and returned a verdict of "Accidental death."

The New Gas-Works Scheme for Aberavon.—Mr. W. A. Ducat, a Local Government Board Inspector, attended at Aberavon last Wednesday and held an inquiry into the Council's application to borrow £11,307 for purposes of new works. Mr. Trevor Hunter, a local solicitor, opposed the application, on the ground that the existing works could be so altered and improved as to meet the town's requirements. After the Town Clerk had briefly opened the case for the Corporation, Mr. W. Newbigging said he had gone very carefully into the question of Aberavon's gas supply, and had found the existing works were very old, the plant antiquated, and far too small to meet the present requirements—in fact, with the exception of the gasholder, the whole of the plant was insufficient. He handed to the Inspector his detailed bills of quantities and other particulars. Mr. Hunter cross-examined Mr. Newbigging with the view of showing that, with certain new plant—a scrubber, purifiers, condenser, &c.—the existing works would meet requirements; but the witness said he could not advise such a course, as the site was altogether too small. Mr. A. Bond, the Manager, was called and supported Mr. Newbigging's evidence. Mr. W. H. Bond, a former Manager, said he opposed the scheme, but could give no reasons for so doing. He readily fell in with the suggestion of the Inspector that it was one of expense only. The Town Clerk (Mr. M. Tennant), in cross-examining Mr. Bond, elicited from him the fact that he had over and over again, during his management of the works, advised the Council to adopt the course they were now taking. There was no further opposition evidence.

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SALTLEY WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000
ROCHESTER (Second Contract)	500,000
NEWPORT (MON.)	250,000
TOKIO, JAPAN	1,000,000
PERNAMBUCO (Brazil)	125,000
MALTON	150,000
DULUTH, MINN. (Second Contract)	300,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 Cub. Ft. SMETHWICK, 500,000 Cub. Ft. LEICESTER (2nd Cont.), 1,000,000 Cub. Ft.
GRAVESEND, 300,000 C. Ft. BROCKVILLE (ONT.), 250,000 C. Ft. NEWPORT, MON. (2nd Cont.), 250,000 C. Ft.

An Austrian Oil Trust.—An Oil Trust has been formed in Austria with the object of competing with the American and Russian Companies. The Trust will shortly send representatives to Germany, Switzerland, and France to report upon the state of the oil market and openings in these countries for pushing the trade. The new Company has a large capital, and is supported by wealthy financiers. It is generally understood that this step has been taken to counteract the recent action by American oil firms to capture the European market. There is a rumour that the new Company intends joining hands or buying out the Russian oil firms.

Decrease in the Stock of Water at Oldham.—According to the usual statistics presented at the fortnightly meeting of the Water Committee of the Oldham Corporation last Wednesday, the quantity of water in store on the previous day was 903,370,000 gallons; showing a decrease of 5,040,000 gallons during the fortnight. The stock for the corresponding fortnight last year was 988,070,000 gallons. The stock of water at Castleshaw and Strinesdale is sufficient to last $6\frac{1}{2}$ weeks, and at Denshaw and Piethorn there is $6\frac{3}{4}$ weeks' supply. It transpired at the meeting that in order to keep the water supply up to a thoroughly satisfactory level, $1\frac{1}{4}$ inches of rain every fortnight would be required.

Fire at the Kendal Gas-Works.—At 11.45 p.m. on Sunday, the 17th inst., a fire was discovered to have broken out in the governor-house at the Kendal Corporation Gas-Works. The fire brigade were promptly on the spot, with an engine; but it was found that the pressure in the main was sufficient to enable them to cope with the fire, which was soon under complete control. The Gas and Water Engineer (Mr. T. N. Ritson) deemed it advisable to turn off the gas supply to the town; consequently the streets were in darkness. The roof fell in, and considerably damaged the machinery. The *débris* was cleared away by the workmen of the Corporation, and gas connection was restored about seven hours after the men had got to work.

Explosions of Gas.—A remarkable gas explosion occurred last Thursday at the Hounslow Station on the London and South-Western Railway. A 600-light meter from the Hounslow Barracks, having undergone repairs, had been returned from the Metropolis by goods train. The goods clerk and four porters were endeavouring to move it on to a van, when it suddenly burst with a terrible report, throwing all the men to the ground. Windows were shattered, the door of the goods shed was wrenched off its hinges, and the booking office was wrecked. The explosion is somewhat of a mystery, for it cannot be understood why there was gas in the meter. The goods clerk and the porters were severely shaken; but fortunately they did not sustain any very serious injury. A gas explosion, followed by a fire, occurred on the same day at No. 35, Cock Lane, Snow Hill, E.C., on premises jointly rented by the Empire Safe and Lock Manufacturing Company, Mr. W. R. Lacey, and Mr. H. J. Rodgers. The third floor was wrecked. Mr. Herbert Rodgers was so badly burnt that he had to be removed to St. Bartholomew's Hospital.

Poisoning by Carbonic Oxide.—At the annual Congress of the Royal Institute of Public Health at Exeter, last week, Mr. J. C. M'Walter, M.A., of Dublin, brought forward the question of "The Prevalence of Poisoning by Carbonic Oxide." He pointed out that there was no law at present to prevent gas makers from allowing carbonic oxide to pass into their pipes; and several cases of death could be traced thereto; and they had come to the conclusion that the number of instances of poisoning short of death was very large. Cases were overlooked owing solely to the want of practical tests for the presence of this gas. He moved—"That the Exeter Congress of the Royal Institute of Public Health considers that the composition of gas supplied for illuminating purposes should be subject to the control of the local sanitary authorities." The President remarked that the question of the supply of water gas was, no doubt, one which would become very prominent. Dr. Symons, the Medical Officer of Health for Bath, said water gas had come to stay. Its manufacture was a very much cleaner and healthier process than the old one, only care must be taken that the gas was made to burn thoroughly. The resolution did not commend itself to him. After some desultory discussion, it was suggested that the motion should be brought before a larger and more representative gathering of the members of the Institute: and it was accordingly withdrawn.

Anglo-Belgian Welsbach Incandescent Gas-Light Company.—An extraordinary general meeting of this Company was held last Wednesday at Winchester House, E.C.—Mr. G. E. N. Ryan presiding. The Chairman said it was a great disappointment to the Board that the profits of the Company had been so reduced by the competition to which they had been subjected. They had been in an almost incessant state of lawsuits ever since they commenced; and although they generally obtained verdicts, they had no means of enforcing them, and, in the end, generally found themselves saddled with the costs of both sides. Under these circumstances, the Directors desired to amalgamate the concern with a new company with more capital and better able to defend itself against unscrupulous competitors; and in the scheme the Directors laid before the shareholders, the capital was very moderate. By combining an admirable system of heating and cooking with that of lighting, they were hopeful of good results. It was also proposed to extend the sphere of operations of the new Company to Holland, and a largely increased business was confidently expected. Their present Managing-Director in Belgium (M. Sepulchre) would have a seat on the Board of the new Company. The preference shareholders would receive under the scheme a 5 per cent. preferential security, and a further amount in the form of a sinking fund, which would during 30 years, by gradual fixed drawings, return the capital at par value. The prospects of the ordinary and deferred shareholders as regards dividends would also be much advanced. Resolutions were passed ratifying and sanctioning the agreements which had been entered into providing for the sale of the Company's business to the Société Belge de Chaleur et Lumière, and arranging for the voluntary winding up of the Company.

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Leeds Corporation Water-Works Awards.—Mr. F. S. Broderick, of Hull, the Arbitrator, has made his award in connection with the compulsory purchase by the Leeds Corporation of land at Fewston, owned by Mrs. Jane Grace North. The award is £1360 for purchase and compensation. For 35a. 3r. 7p., the property of Mr. W. Beecroft, a farmer, of Fewston, the award is £3420. The estates are required by the Corporation in connection with the water-works they are carrying out in the Washburn Valley.

Gaslight v. Moonlight at St. Ives.—A not uncommon complaint in small country towns was made at the meeting of the St. Ives (Cornwall) Town Council on Wednesday last, when attention was called to the fact that, owing to the extinguishing of the gas-lamps on the assumption that the moon would be shining, the streets had been very dark for several nights. Mr. Faull, who brought the matter forward in the interest of visitors to the town, proposed—"That we do not study the moon in future." The Mayor (Mr. W. Craze) pointed out that this meant an increase in the cost of lighting; and Mr. Faull then suggested, as a compromise, that the lamps should be lighted until 11 p.m., and that a few should be kept burning all night as guides. This is to be considered at a future meeting.

The Beneficial Effects of Profit-Sharing.—The following letter from Mr. W. H. Hall appeared in "The Times" on Saturday: "Some twenty years ago, it fell to my lot to relate, in a pamphlet published by the Manchester Co-operative Wholesale Society, how the famous Parisian house-painter and decorator Leclaire successfully introduced profit-sharing into his business. It was highly gratifying to me to learn, from a speech delivered by Sir George Livesey on the occasion of admitting the workmen employed by the South Metropolitan Gas Company to share in the profits, that he had been encouraged to do so by the example of Leclaire. In your issue of Aug. 22, I find Sir George Livesey again advocating the system of profit-sharing in a speech on labour association. As you bring the subject prominently forward in a leading article, I think it may be encouraging to others to learn that, following the enlightened lead of the late Lord George Manners in the Newmarket district, I have been amply rewarded by the result of introducing a mild form of profit-sharing into my own extensive farming operations. Whenever the seasons have admitted of my making any profit at all, all my labourers have shared to a small extent that profit with me—the leading men receiving £2, the rank and file about 15s. per man, in addition to their ordinary wages. I hope this year to divide a somewhat larger share, if the promise of a larger profit is realized. My relations with the 70 odd men and boys employed are unquestionably sweetened by the adoption of even this beginning of profit-sharing."

According to a Laffan telegram, Mr. Columbus Johnson, an expert on water questions, had arranged to sail for Glasgow last Saturday, to study the systems of water supply in Europe, with the view of improving that of New York.

The Cross Incandescent Light Company, Limited, has been registered with a capital of £1000, in £1 shares, to carry on the business of manufacturers, merchants, and agents for raw cotton, incandescent mantles, gas and electric fittings, chemicals of all descriptions, and any materials used for the manufacturing or preparing of any of the above-mentioned articles.

The Board of Trade have received from the Collector of Customs at Port of Spain a communication stating that though for a long time the existence of oil in connection with the asphalte deposits in Trinidad has been known, until lately there was no proof of its presence in considerable quantities. Now, however, wells are being exploited—some a little to the north of Pitch Lake, and others at Guayaguayare, in the extreme south-eastern corner of the island. The latter are supposed to be the richest. No great quantity has yet been brought to the surface, operations being in abeyance until ample storage is provided; but the experts in charge of the works believe that the supply is very large. Analytical reports speak most favourably of the oil, which is said to be peculiarly rich in illuminating and lubricating constituents, and to lend itself readily to refining.

Reporting upon the steps taken during the past year to abate the smoke nuisance in London, Mr. A. Spencer, the Chief Officer of the public Control Department of the London County Council, points out the difficulty of obtaining convictions under the provisions of the Public Health (London) Act, 1891. He says: "The only provision that appears to be really valuable is section 24 (*b*), which deals with black smoke; and probably this is the only part of the smoke sections of the Act (except the sub-section dealing with river steamers) which is enforced in London. Smoke of other colour than black may, and does when it is discharged in considerable volume, cause very serious nuisance. In addition to this limitation on the powers of a sanitary authority for dealing with smoke nuisance, the statutory procedure involves much unnecessary delay. Two successive formal notices have to be served before any liability to penalties is incurred, so that for a time nuisance can be continued with impunity. The Public Control Committee suggest that the law should be amended, section 24 (*b*) being strengthened by adding the words 'or other smoke' after the words 'black smoke,' so as to make this section cover any serious emission of smoke from a chimney. The imposition of a direct penalty is suggested, not exceeding £10 for the first offence—this to be increased for subsequent offences. This course is advised, instead of applying to smoke nuisance, as at present, the complicated procedure that may be applicable to a sanitary nuisance." Evidence of 6286 cases of smoke nuisance has been furnished since June, 1892, by the County Council to the various sanitary authorities in London. During the year ended March 31 last, legal proceedings were taken by Metropolitan Borough Councils in 119 cases, in 106 of which convictions were obtained and aggregate penalties imposed amounting to £550. The generating stations of electricity supply undertakings are largely responsible for smoke nuisances.

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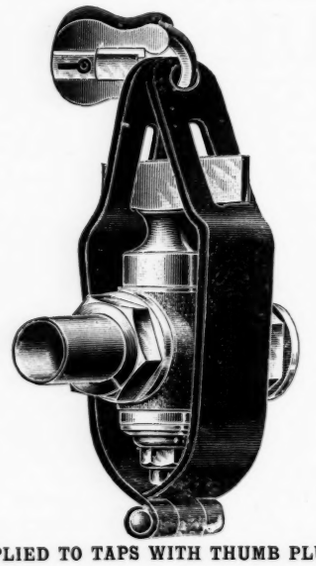

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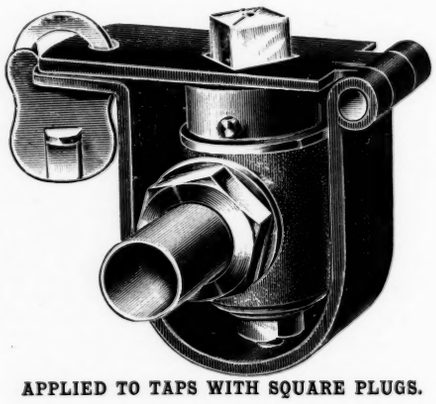

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